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ABSTRACT

This second volume of a two-volume set on prevention of cancer in the workplace is a self-instructional manual designed for independent study by students who consult on a regular basis with an instructor. The manual follows a consistent format. The narrative text in each of three sections presents current knowledge about the subject and refers to readings in the course textbooks. Exercises, following each section of the manual, are designed both to assess student learning and to extend student thinking about the issues discussed in the chapter. Suggested readings provide further references for the student. A glossary summarizes the technical terms used throughout the manual. It also contains a self-assessment questionnaire that may be used as both a pretest and a posttest. Finally, the manual provides a sample individualized learning contract that can give structure to the study. The three sections of the manual cover the following topics: a scientific look at cancer, cancer prevention, and topics of special interest (radiation and cancer, literary portrayals of the workplace, psychosocial aspects of cancer, and federal intervention efforts). A short glossary and lengthy bibliography complete the manual. (KC)

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PREVENTING CANCER IN THE WORKPLACE AND COMMUNITY

Volume II

Division of Behavioral Sciences and Health Education
School of Public Health, University of California, Los Angeles
and
Southern Occupational Health Center

Empire State College, State University of New York

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PREVENTING CANCER IN THE WORKPLACE AND COMMUNITY

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September 1983

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Volume II

Cancer, the Worker and the Community

An Independent Study Guide

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PREFACE

Cancer and workplace carcinogen exposure is a subject of great concern both to workers and to the industrial community as an increasing number of new substances are introduced into work processes and the work environment. While scientists and policymakers argue the controversial issues surrounding cancer etiology and "safe" exposure levels, workers face the immediate threat of exposure to workplace carcinogens. Worker education, essential to the success of preventive measures, remains an ongoing challenge for unions, management and educational institutions.

Preventing Cancer in the Workplace and Community represents a collaborative effort to reduce the knowledge gap in the area of workers' education about cancer, its causes and its prevention. The two volumes in the series are the culmination of three years of collaborative work by the University of California, Los Angeles, School of Public Health, the Johns Hopkins University School of Hygiene and Public Health, and SUNY-Empire State College and its Center for Labor Studies. Each volume is intended for a different audience:

Volume I, Cancer, the Worker and the Workplace, is a teacher's guide designed to serve as a basis for lecture presentations and class discussions within the context of a formal course setting and structure. The prototype for this volume was originally developed and field-tested at the SUNY-Empire State College in Albany and its Center for Labor Studies in New York City.

Volume II, Cancer, the Worker and the Community, is a self-instructional manual designed for independent self-study by individual students who consult on a regular basis with an instructor. The instructor's role is to monitor student progress towards meeting objectives of the course. The prototype for this independent self-study was developed at the SUNY-Empire State College in Albany.

Prior to the development of both volumes, a survey of over 500 Center for Labor Studies students was conducted to assess workers' knowledge of cancer and carcinogens, and their attitudes and behavior regarding preventive action

and health maintenance. Data from this survey were used to develop curricula designs that would reflect what workers need and want to know.

The following reviewers provided us with many useful comments from their areas of expertise: Drs. Anna Baetjer and Charles Billings, Department of Environmental Health Sciences; Dr. Morton Levin, Department of Epidemiology; Dr. Steven Schwartz, Department of Behavioral Sciences; and Mr. Michael Sheridan, doctoral candidate in the Division of Health Education, all from The Johns Hopkins University School of Hygiene and Public Health; Dr. Beatrice Kavasznay of the Bureau of Environmental Epidemiology and Occupational Health, New York Department of Health; Dr. Steven Hecher, Labor Education Center, University of Oregon and Dr. Frederick P. Li, Head, Clinical Study Section, Clinical Epidemiology Branch, National Cancer Institute. We are indebted to them for their thoughtful critiques of the curricula's original draft. Marianne Brown, Andrea Hricko, Dr. Dean Baker, Division of Epidemiology and Dr. John Froines, Division of Environmental and Occupational Health Sciences at the UCLA School of Public Health provided valuable technical advice for the curricula's revisions. Special thanks to Linda Delp for careful editorial assistance with the manual. Dr. Jess F. Kraus and Dr. James Whittenberger assisted with support from the University of California Southern Occupational Health Center. We also wish to acknowledge the following for their assistance: Dr. Richard Dwyer, Ruth Mathews, Ellen Roznowski, Mari Scherne, the support staff of Empire State College, the students who provided valuable feedback, and at University of California, Los Angeles, Phyllis Jacobson, curriculum consultant, Maria Cuevas, Ruth Gooley and Mary Hunter, Gila Weinstein, Judy Malunda and Jim Seale at the Word Processing Center.

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FOREWORD: Environmental Cancer as a Community Issue

As Susan Sontag vividly described in her recent work, Illness as Metaphor, 20th century cancer has replaced 19th century tuberculosis as the dread disease, dreaded largely because its causes and cure remain a mystery despite continued research. By considering the interaction between cancer and possible cancer-causing agents in the environment, one raises a controversial issue which immediately divides researchers, industrialists, environmentalists, and citizens. The curious student reading about environmental and occupational cancer will quickly encounter the controversies expressed in the literature and in research studies. For example, there is much debate about what causes cancer: is cancer genetically predetermined, a result of viruses, or a result of exposure to substances in the environment? Estimates of the percentage of cancer caused by occupational factors alone range from 1% (WHO, 1976) to as much as 40% (National Cancer Institute, 1978), surely an impressive difference.

The basis for debate revolves around who and what is responsible for cancer. Environmentally-caused cancer is especially controversial: are individuals mostly to blame for unhealthful lifestyle habits or are companies or the government responsible for maintaining a workplace and community environment free of cancer-causing substances? Political and economic interests heavily influence whichever position one adopts, whether one stresses individual or institutional blame. Thus, cancer is a community issue which has social implications, and which is of legitimate concern to all of us, not just to scientists.

This study manual presents an overview of environmental cancer, particularly occupationally-related cancer, and allows students to focus on issues and problems of special interest to them. It is hoped that this manual will help students to see more clearly the range of opinions and positions in this emotionally-laden area and to assess the legitimacy of various viewpoints and research interpretations.

NOTE TO USERS

This manual is designed as a problem-oriented approach to the question of environmental cancer and its possible prevention. It is structured so that it can be used either in its entirety or in part by individuals wishing to know more about how to make changes in their own lives or to help others do so. Readers may complete the manual as a course of study designed to allow them to:

1. Examine their own environment, background and personal life style in regard to what is known about environmental and occupational cancer,
2. Learn about the nature and causes of cancer,
3. Understand that learning can and should be used beyond the classroom setting and can occur throughout life through personal observation and experience,
4. Apply learning about cancer to a practical setting such as the workplace, the home, and the community.

The manual follows a consistent format. The Narrative Text Material in each of the manual's three sections presents current knowledge about the subject. The manual also refers to readings in the course textbooks. It is strongly suggested that students read the appropriate textbook sections as noted in the manual. Exercises follow each section of the manual. These exercises are designed both to assess student learning and to extend student thinking about the issues discussed in the chapter. Finally, Suggested Readings provide further references for the interested student. A Glossary summarizes the technical terms used throughout the manual.

The manual also contains a Self-assessment questionnaire. Students should complete this questionnaire before beginning the manual. It is suggested that students complete the questionnaire a second time after the the course is completed as a means of evaluating any overall changes in knowledge and/or attitude.

The required texts for students seeking academic credit are:

Epstein, Samuel. The Politics of Cancer. San Francisco: Sierra Club Books, 1978.

LeServe, Vose, Wigley and Bennet. Chemicals, Work and Cancer. London: Thomas Nelson & Sons Ltd., 1980.

The Epstein text was selected for its broad approach to the subject of environmental and occupational cancer and for its readable style, although the author does have a distinct bias regarding the causes of cancer and how it might be prevented. For readers wishing to make comparisons with other points of view, readings may be selected from the Annotated Bibliography (Appendix A). The LeServe text is an excellent guide to understanding hazardous chemicals, (particularly those that cause cancer) and how they affect workers.

The subject matter of the course is organized within the manual as follows:

Section I discusses the nature and causes of cancer, including cancer hazards, human studies (epidemiology), and animal studies. Technical concepts have been simplified to make them more understandable to the general reader who may have little or no science background.

Section II focuses on prevention and regulation with major emphasis on primary prevention. It describes social and psychological aspects of health related behavior, economic considerations, prevention through communication and through regulatory agency efforts.

Section III gives examples of ways the reader may explore areas of special interest. Students are not limited to the topics suggested here; they serve only as illustrations.

One final aid to the student using this manual as an independent study guide for academic course credit has also been provided: an Individualized learning contract. Individualized learning contracts are an alternative instructional approach that give structure to a study while allowing for flexibility and creativity. The sample learning contract that follows is illustrative of those used at Empire State College, the nontraditional college of the State University of New York where an individualized degree program is designed for adult students.

SELF-ASSESSMENT QUESTIONNAIRE

Please check one answer to each of the following questions:

1. With whom are you most likely to discuss your fears of getting cancer?

___Family and Friends ___Doctor/Nurse ___Co-Workers ___Religous Leader

2. What is your major source of information about cancer?

___Co-Workers ___Employers ___Doctor/Nurse ___T.V. & Magazine or Newspaper

___Others, specify: _____

3. How frequently have you discussed cancer work hazards with your co-workers?

___Never ___Sometimes ___Often

4. What is your major source of information about possible hazards, on the job, that may be related to cancer?

___ Employer
___ Union
___ Doctor/Nurse
___ Co-Workers
___ Family Members
___ T.V. or Radio
___ Books
___ Newspaper or Magazines
___ Others, please specify _____

5. Do you now or have you ever smoked cigarettes?

___Yes ___No (if NO, skip to question 6)
(if YES, answer questions A & B below)

A. Have you cut down on the number of cigarettes you smoke because you were worried about your health?

___Yes ___No

B. Have you quit smoking because you were worried about your health?

____Yes ____No

6. When you drive or ride in a car, do you wear seat belts?

____Never ____Sometimes ____Often ____Always

7. Has anyone ever recommended you wear or use personal safety devices such as earplugs or respirators in connection with any aspect of your job?

____Yes ____No (if YES, answer question A below)
(if NO, go on to question 8)

A. Do you wear or use these devices when they are recommended?

____Never ____Sometimes ____Often ____Always

8. Do you think it is likely that you will develop cancer some day?

____Very likely ____Somewhat likely ____Not at all likely

9. If you were to get very seriously sick or injured some day, what do you think the cause would be?

____Car accident ____Heart trouble ____Cancer ____Diabetes

____Other (Please describe _____)

10. Do you believe that you have ever worked with any substance which may be cancer-producing?

____Yes ____No ____Not sure

11. Do you think the average worker in American comes in contact with hazardous substances at work which may be cancer-producing?

____Yes ____No ____Not sure

12. Is there any type of health and safety group at your worksite?

____Yes ____No ____Not sure

13. Please rate the following in order of their importance to you (rank the most important 1 to the least important, 6):

____job security
____career advancement
____maintaining comfortable standard of living
____education of your children
____taking care of your health
____doing interesting and satisfying work

14. Which of the following have been linked to an increase to cancer:

	Definitely Linked	Not Sure	Definitely Not Linked	Don't Know
1. Smoking cigarettes	____	____	____	____
2. Eating foods with chemical additives	____	____	____	____
3. Being in a hurry and rarely relaxing	____	____	____	____
4. Exposure to hazards in the air and water in the community	____	____	____	____
5. Failure to use protective devices at work	____	____	____	____
6. Having cancer in your family	____	____	____	____
7. Too much exposure to sunlight	____	____	____	____
8. Exposure to X-rays	____	____	____	____
9. Use of microwave ovens	____	____	____	____
10. High salt diet	____	____	____	____
11. Lack of exercise	____	____	____	____
12. Being friends with someone who has cancer	____	____	____	____

15. Warning signs of cancer include which of the following: (Check Yes or No for each)

	Yes	No
1. Unusual bleeding or discharge	____	____
2. A sore that does not heal	____	____
3. Indigestion or difficulty in swallowing	____	____
4. Headaches	____	____
5. A change in wart or mole	____	____
6. A lump or thickening in the breast or elsewhere	____	____
7. High blood pressure	____	____
8. A change in bowel or bladder habits	____	____
9. Fainting	____	____
10. Chest pain	____	____
11. Hoarseness or cough	____	____
12. Skin rashes	____	____

16. Please check true or false for each of the following statements:

	True	False
1. Cancer-causing substances cannot enter the body through contact with the skin.	____	____
2. Cancer-causing substances may be drawn into the lungs when you breathe.	____	____
3. It is possible to swallow a cancer-causing substance.	____	____
4. You can tell right after exposure to a cancer-causing substance that you are going to get cancer.	____	____
5. It generally takes between 5 to 20 years for cancer to show itself.	____	____
6. Most people exposed to cancer-causing substances will develop some kind of cancer.	____	____

17. Please check the answer you think is correct:

	True	False
1. Hazardous substances at the workplace are responsible for many types of cancer.	___	___
2. Hazardous substances at the workplace may be carried home and harm family members of workers.	___	___
3. You can always tell if you have been exposed to a hazardous substance.	___	___
4. All of the important hazardous substances have been identified.	___	___
5. Office workers really don't have any workplace hazards to worry about.	___	___
6. The risk of developing cancer is greater in the city than in rural areas.	___	___
7. There are "safe" levels of cancer-causing substances at which exposure won't present a hazard to the worker.	___	___

SAMPLE LEARNING CONTRACT

A. PURPOSE:

To achieve an understanding of occupational and environmental cancer in relation to (a) the nature and causes of the disease, and (b) possible areas of prevention through individual and organizational change, regulation, and education. (3 Credits)

B. LEARNING ACTIVITIES:

1. The student will use the manual, Cancer, the Worker and the Community, follow the authors' directions for study in each section, and complete all assignments in consultation with the instructor.
2. The student will identify an area of special interest and develop a topic for further investigation. This may consist of preparation of a research paper, a case study based on the method described in the manual, or any other project that will enhance understanding of the topic. Examples of such endeavors are: a research paper on local PCB contamination; a case study of cancer in a family or in a particular industry; involvement with a grassroots community group concerned about a pollution problem or with a community education project of the local cancer society.
3. Whichever option is selected, an outline and draft of the project should be submitted to the instructor for comment and revision early in the course of study and a final version completed by the end of the course.
4. The student will meet the instructor every two weeks or as mutually agreed upon for discussion and review of materials.

C. EVALUATION:

The student's work will be evaluated for an understanding of the nature and causes of cancer and for an understanding of different approaches to preventing cancer. Evaluation will be based upon discussions with the instructor, submission of written materials as in (3) above, and upon completion of the assignments in the manual, Cancer, the Worker and the Community. The instructor will review all work for content and format and will consult with appropriate experts as necessary.

SECTION I

A SCIENTIFIC LOOK AT CANCER

Introduction: The Importance of Knowledge

A. What is Cancer?

B. What Causes Cancer?

C. How do Scientists Investigate Cancer and Cancer Hazards?

D. How is Scientific Information Used to Control Cancer Hazards?

A SCIENTIFIC LOOK AT CANCER

INTRODUCTION: THE IMPORTANCE OF KNOWLEDGE

As with many things we fear, we are strongly tempted either to avoid thinking about cancer at all, to be fatalistic, or to accept simple analyses and easy solutions which assign the responsibility of dealing with cancer to someone else. From the media, from our conversations with people, from our own thoughts, we all can probably recognize the following kinds of ideas about cancer: everything you eat is carcinogenic; if the government can put man on the moon, it can find a cure for cancer; if you are exposed to this level of radiation you are safe, but if to that level you will get cancer for sure; there is a conspiracy of silence about cancer hazards; a breakthrough in cancer cures is just around the corner. Whether any of these is wholly or partially true may be important as a matter of objective fact. But more important for our communities and ourselves is the need to recognize that our acceptance (or rejection) of those statements should be based on our best understanding of the problem at hand. There is much that is not known about cancer, but there is also much that is known.

As you read the following text and accompanying references, remember that authors writing controversial issues tend to present their own biases, generally selecting evidence to support their viewpoints. This is especially true of a subject area like cancer where theories and opinions have of necessity been formed while much scientific knowledge is still lacking.

The LeServe book is a slim and simply written volume primarily oriented to chemical workers. The scientific information it contains, however, is more substantial, more clearly presented and more instructive than other books many times its size. This book, published in Great Britain, occasionally refers to specific British situations and examples. This should not be any problem as long as the reader is aware of these circumstances. In fact, these references can serve the useful purpose of reminding us that disease and problems of health and safety have little regard for national boundaries.

The Epstein text, which covers the subject of cancer in understandable language for the general public, tends to show more bias in presenting the author's views. The careful reader should try to recognize and understand the author's point of view on the one hand and, on the other, be prepared to challenge these views if the author fails to make them believable. In the research and discussion of any complex subject area involving human beings, some conclusions are scientifically defensible and others are not. And even while everyone may share the same "scientific" findings, it is still possible to draw different conclusions as to the best solutions to problems. For Epstein, who is himself a physician-scientist, the conclusion seems to be that the solutions to the problems of cancer must primarily be political ones. Thus, although much of the book deals with scientific questions, the title is The Politics of Cancer.

We urge you, as readers of scientific research, to examine critically the evidence presented by "experts" and to draw your own conclusions. Cancer is a problem that faces us all in a personal way; each of us must become more knowledgeable if we want to control elements in our environment that may be cancer-producing.

A. WHAT IS CANCER?

Cancer is a disease process. The following are the most important ideas to understand about this process:

- Cancer is not a single disease but a group of diseases generally characterized by uncontrolled growth of abnormal cells. This uncontrolled growth causes different kinds of health problems depending on the type of cells affected.

- Normal cells have specific functions. The activities of cells and their orderly replacement are controlled by the material in the genes called DNA. Under the control of the DNA, normal cells reproduce themselves at the rate appropriate to maintaining their specialized functions.

- Changes in the DNA can lead to uncontrolled cell reproduction, frequently giving rise to a tumor.

- Tumors are classified as benign or malignant. Malignant, or cancerous, cells are characterized by a loss of their capacity to differentiate into specialized cells with particular functions. Benign tumors have cells similar to the cells of the surrounding tissue and do not spread to other parts of the body. Malignant tumors can metastasize i.e., spread from the original or primary site to give rise to secondary growth in other areas of the body.

- The symptoms of cancer that an individual can see or feel are a result of the disease process. When a tumor growth invades surrounding tissues, the resulting health problems may appear to be similar to other types of illness but they remain and often worsen as the malignant cancer progresses. Some symptoms that may appear are persistent headaches or paralysis which result from brain tumors; difficulty in breathing or a collapsed lung resulting from a tumor obstructing the lung; and infections, bleeding or sores that do not heal resulting from tumors that invade the skin tissue.

B. WHAT CAUSES CANCER?

The many theories about what causes cancer place possible sources of cancer into three general categories: genetic (hereditary), biological (viral, hormonal), and environmental (personal habits, workplace exposure, and general environmental exposure). The genetic and biological sources are often considered "naturally-occurring," i.e. humans have relatively little control over them. Environmental sources are usually "human-made" and are associated with two kinds of human activities - one's own personal habits (smoking, eating, drinking, etc.) or larger-scale activities that pollute the workplace or environment. These categories are not mutually exclusive: other people's personal smoking habits cause environmental pollution that affects everyone in the immediate environment; naturally-occurring radiation from the sun and

naturally-occurring viruses are both components of the environment; and environmental pollutants such as radiation and chemicals can cause genetic and biological changes which increase the chance of getting cancer.*

Inasmuch as the theme of this study is centered on cancer prevention through knowledge and action on the part of workers and the community, our emphasis would naturally be on understanding those cancer-causing agents over which we have some control. These are generally agents which are considered environmental. The environment of particular concern, as we shall see, is often the industrial occupational environment.

What evidence is there that cancer causation may be environmental in origin? The key to answering this question is to examine the pattern of cancer occurrences. If the pattern followed racial, national or familial lines, genetic factors would of course be predominantly suspect. If, on the other hand, there are large geographical variations in the incidences of cancer irrespective of nationality and race, then it is certainly reasonable to suppose that there may be environmental factors.

The concept of environment may be very broad. Not only might one consider the physical environment of the air we breathe and the food we eat, one could include as well the cultural environment which may forbid certain behaviors and encourage others. It is even possible to consider the question of psychologic environment. For example, a highly emotional environment may affect human bodies in ways that favor cancer development. Not only is there a large variety of environmental and other factors, but these factors may also be interrelated. For example, someone may be born with a genetic predisposition (a hereditary factor) to a particular hormonal imbalance (a biological factor) which does not become a problem until the person is exposed to a certain chemical in the water supply (an environmental factor).

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* Refer to Cairns, Cancer: Science and Society, (see bibliography for complete reference). Cairns' book emphasizes the biological aspects of cancer and is a good reference for readers who want a better understanding of the more technical theories of cancer causation.

Students taking this course for credit should now read Epstein, Chapter 1 ("Environmental Causes of Cancer") and Chapter 2 ("Cancer, Geography and the Environment").

In support of the idea that cancer has environmental causes, both LeServe and Epstein cite specific examples of the clustering of high cancer mortality rates in particular geographical locations. In the latter section of Chapter 3, LeServe briefly discusses the environmental causes of cancer, distinguishing the natural environment from the industrial environment. This connection between the environment and cancer is treated much more extensively by Epstein. He cites many examples of a relationship between heavily industrialized areas and higher rates of cancer and cancer-caused mortality. These examples not only support the theory that cancer has environmental causes but also target the industrial environment as a special problem area.

The clustering of high mortality rates in industrialized areas is graphically and convincingly presented in a series of maps which show cancer mortality in the United States by county. Typically, high mortality rates are found in heavily populated urban areas and in regions with high levels of industrial activities. Figure 1 shows a map depicting the geographic areas where mortality from cancer of the trachea, bronchus and lung among white males is significantly higher than in the rest of the US population. Mortality is excessive in a belt of counties on the southeast Atlantic Coast, in northern New Jersey, New York City, and along the Hudson River. Excessive mortality, however, is not limited to highly populated areas where cigarette smoking and air pollution are most prominent. In fact, the rates are highest along the Gulf Coast from Texas through Florida, with the heaviest concentrations in Louisiana. Based on this map and on a knowledge of the important industries in those areas, one can explain the variations; the factors that contribute to the excess cancer mortality are asbestos use in the shipbuilding industry and the presence of many petrochemical plants. Epstein also discusses the cancer map concept in Chapters 1 and 2 referenced above.

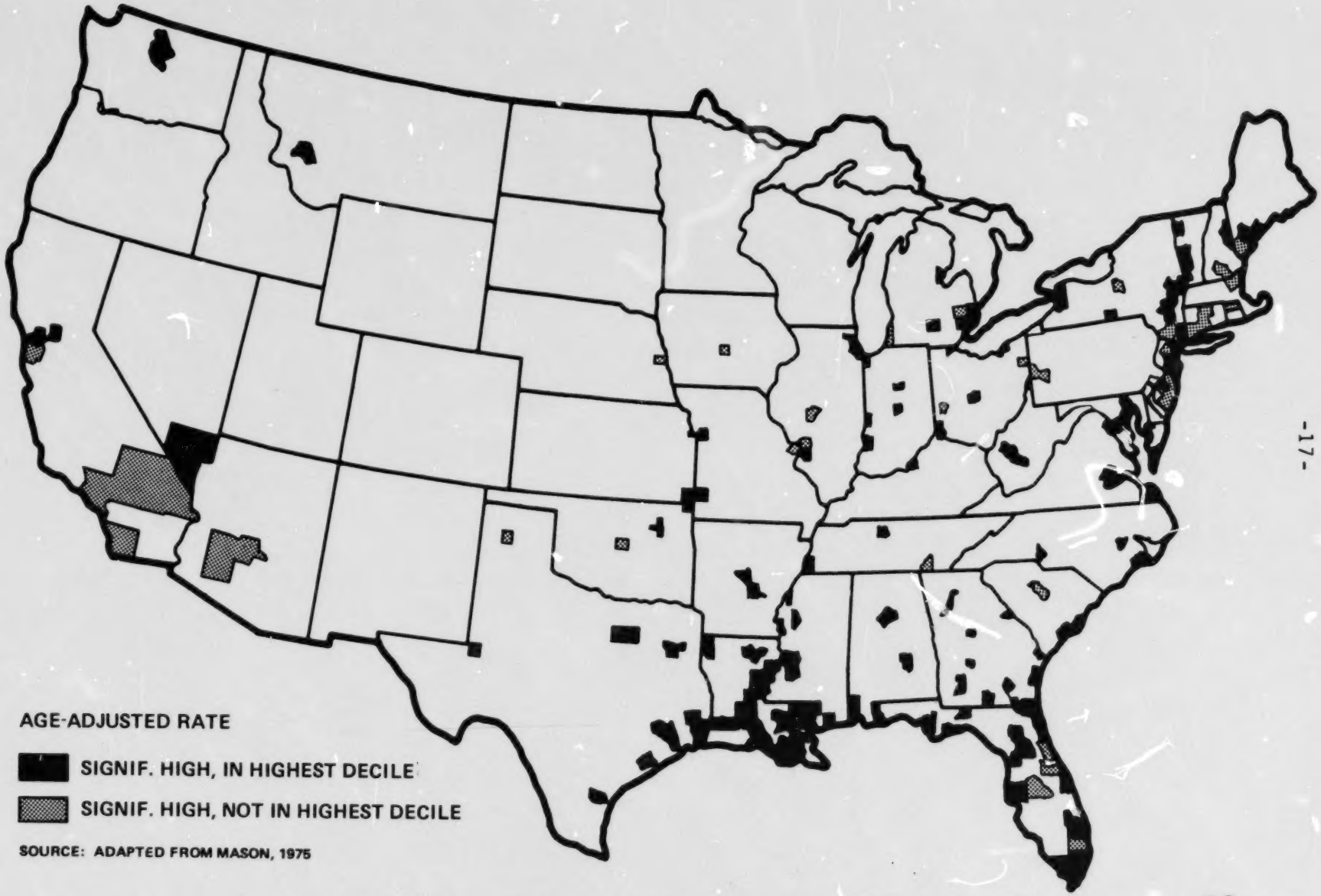


Figure 1. Trachea, Bronchus and Lung Cancer Mortality 1950–69, by County, White Males.

In books and articles on environmental cancer, one often finds statistical quotations that appear to differ greatly one from another. For instance, Epstein claims that "environmental factors cause 70 percent to 90 percent of all cancers" (p. 23). This contrasts dramatically with numbers as low as 1-3%, which LeServe cites from various sources. How can these wide variations be explained? Some of the differences are due to different definitions of the environment. One person may define the environment as the immediate workplace surroundings; another may have a broader definition which includes community air and water supplies. When referring to environmental sources of carcinogens, someone may mean any combination of lifestyle, occupational or general environmental exposures. One of the reasons Epstein attributes a much higher percentage of cancer to environmental factors than does LeServe is that Epstein is referring to any type of environmental cancer while LeServe is referring only to occupationally-induced cancer. Workplace carcinogens are hazards to a specific group of people but everyone is exposed to the general environment. However, even estimates of the percentage of cancer caused by occupational exposure alone vary greatly. WHO (1976) estimates that occupational factors account for 1-3% of cancers while the National Cancer Institute (1978) estimates 20 to 40%.

Other reasons for the wide variation in figures attributing cancer to environmental factors are related to the nature of cancer as a disease process and to the difficulties scientists encounter when attempting to investigate which substances might cause cancer:

1. Since cancer is a disease process, it may be some time before any noticeable symptoms appear. LeServe (in the section "Why is data so variable?") highlights a major difficulty in determining what may have caused cancer: there is a latency period (or waiting period) between exposure to a carcinogen and the onset of the disease. Thus, people may not know or may not remember that they were exposed to an environmental carcinogen in their workplace or community 20-30 years before they develop cancer.

2. An environmental carcinogen may produce cancer only in some people and not in others, only at high doses and not at low doses, or only

if the person is exposed to another substance simultaneously and not to that substance alone.

The Concept of "Cancer Hazards"

Anyone who reads a newspaper or listens to news reports can probably contribute examples of environmental cancer hazards associated with industrial products or waste materials. Certain places have come to be considered hazardous places to live (e.g., close to a chemical dump) and certain professions are considered particularly hazardous (e.g., working with asbestos). Implicit in these notions of "hazard" is that there is a greater risk of getting cancer at this home site or this work site. Hazard is, therefore, risk that is associated with a specific site or area. At a particular site, the hazardous agent may be chemical (e.g., benzene), physical (e.g., X-rays), or biological (e.g., viruses). The mechanisms by which damage is caused differ with the different forms of hazards. In this manual, we will limit ourselves primarily to chemical hazards. Radiation, a topic of concern to many, can be studied in Section V of this manual as one of the areas of special interest. Many of the concepts discussed in connection with chemical hazards also apply to other hazards.

The harmful effects of a hazardous substance, or the probability of being injured by that substance, depend on the particular substance and on the situation, i.e., how toxic the hazardous substance is and the amount, or dose, of the substance to which the individual is exposed. The concept of hazard can be illustrated by the equation:

Hazard = Dose x Toxicity

The toxicity of a substance refers to its ability to produce harmful effects. Since some substances are only toxic in huge amounts while others are toxic in very small amounts, it is important to know the dose, or amount, of a substance as well as its toxicity before determining whether the substance is a hazard. When discussing hazards, we want to know two things: whether a substance is capable of causing health problems at any level (its inherent toxicity) and, if so, at what level those problems begin to appear.

Since almost all substances are toxic in excessive amounts (e.g., a medicine that cures when taken in a normal dose can kill at excessive dosages), it is important to determine how much exposure (dose) is "safe" and how much is excessive or unsafe. The dose of a substance depends on the concentration level of the substance and on the length of time someone is exposed to the substance:

Dose = Concentration x Exposure Time

For example, if one is exposed to a moderately toxic substance in fairly diluted form for only a brief period, no harm may be done. But if one is similarly exposed for a long period of time, the dose is increased and the likelihood of harm is increased correspondingly. Thus, hazard, or the probability of being harmed under particular circumstances of exposure, depends on how toxic the hazardous substance is, how concentrated it is, and the length of exposure time. To summarize:

Dose = Concentration x Exposure Time

Hazard = Dose x Toxicity

Efforts to determine whether a substance is a hazard (is it toxic and, if so, at what dose?) are complicated and controversial. Several factors play important roles in efforts to determine and control cancer hazards:

1. Individuals respond differently to hazards under different conditions. A seemingly safe substance may be harmful to a more sensitive person, or when used in a different kind of work process.

2. Scientific investigations to determine whether there is <u>any</u> safe level of exposure are hampered by certain characteristics of cancer which make it difficult to study (e.g., the latency period between exposure and the appearance of health effects).

3. In addition to scientific knowledge, economic and political factors play an important role in determining how much exposure to potentially hazardous substances is acceptable.

The variability of workplace conditions and/or an individual's response to those conditions makes it difficult to determine whether a particular substance will be hazardous to a particular person. LeServe (Chapter 2) summarizes the factors which determine whether a chemical will be hazardous:

1. Chemical structure of the substance
2. Physical form of the chemical (dust, aerosol, vapour, liquid, etc.)
3. Route of entry into the body (inhaled into lungs, ingested into stomach, absorbed through skin, etc.)
4. Tissues and organs in which it collects or localizes
5. The individual's response to the chemical

A substance becomes hazardous to a particular individual when that person's body cannot function properly. The body in many ways is quite marvelously constructed. It is endowed with protective mechanisms, mechanisms for restoring equilibrium when balance is disturbed, and a considerable ability to repair itself even when injury has occurred. However, when the body's natural limits are exceeded, the defenses break down and permanent harm results. In principle, these limits are definable. But in practice, these limits and their relationship to toxic substance exposure are hard to establish. As a matter of legal and moral obligation, researchers are mandated to study the effects of various substances so standards can be defined to protect workers and citizens from toxic exposures.

C. HOW DO SCIENTISTS INVESTIGATE CANCER AND CANCER HAZARDS?

The question of how scientists determine safe exposure limits must be examined in the context of the enormous difficulty of estalishing causality between cancer and potential carcinogens. A characteristic of most cancers is that there is a long latency period (as much as tens of years) between initial exposure to a cancer-causing agent and the onset of the disease. Assuming that a group of workers were known to have been exposed to a particular

substance at a particular level (an improbable situation to begin with), can all of these people even be found again 20-30 years later for us to verify whether they have or have not developed cancer?

The problem of a long latency period is compounded by the complex mechanisms involved in cancer causation (carcinogenesis). Chapter 4 of LeServe ("Chemical carcinogenesis") points out that certain chemicals may themselves cause cancer to develop, while other chemicals may be converted by the body's own action into carcinogens (cancer-causing agents). A key idea of this chapter is that cancer is the product of a complex interaction of several factors.

Chemical carcinogenesis involves at least two stages: initiation and promotion. In the first stage, the initiator transforms a normal cell into a potential cancer cell by mutating the cell's genetic material. In the subsequent stage, the promoter stimulates the division and replication of this abnormal cell. The two stages may involve the same or different chemical compounds. When different compounds are involved, they may be noncarcinogenic or only weakly carcinogenic individually, but may become potently carcinogenic in combination. Besides the initiator/promoter relationship, there are still other mechanisms (e.g., the body's metabolism) whereby the chemical's capacity to induce cancer is altered by the presence of another chemical. When two chemicals working in combination produce an effect (in this case a carcinogenic effect) that is greater than the sum of the two effects of these chemicals working independently, it is referred to as synergism. The possibility of such interactive effects of course greatly complicates the question of exactly what is carcinogenic and at what level of exposure. Our hypothetical group of exposed workers not only have to be found 20-30 years later, they must also be checked for contact with other substances before and since that event.

> Those studying LeServe's text should now read Chapter 4. The first part of this chapter deals with what we have just discussed, while the second part introduces the question of scientific evidence, i.e., how do we determine whether something is carcinogenic.

Why not just do scientifically controlled experiments in the laboratory with animals to study carcinogens? Unfortunately, we cannot automatically assume that what is true of laboratory animals will be true of people. Metabolic processes, for instance, are different for some animals than for people. If carcinogenic properties are to be studied, there is much to be considered about the methodology of research. Approaches to cancer research are covered in Chapters 2 and 3 of Epstein under the common heading "The Science of Cancer." The following discussion summarizes the principal points in those chapters. Those seeking a more detailed understanding of this topic should study Epstein's text.

Epidemiology Studies

Chapter 2 of Epstein is titled "Cancer: The Human Experiment." The human experiment referred to here is not a laboratory experiment, but what Epstein describes as "natural experiments" of observing the pattern of diseases that people contract as they live their daily lives in different workplaces and communities. The search for the cause of disease through the identification of characteristics common to those contracting it is the concern of the science of epidemiology. The epidemiologist looks for factors in the patients' backgrounds that differentiate them from other individuals. For example, they live in a particular area, they belong to a particular race or profession, or they have certain personal habits. The impetus for an epidemiological study may be a suspicion or the observation that a high frequency of cancer appears to be connected with the presence of certain factors. The hypothesis of cancer causation is then subjected to scientific evaluation and statistical analysis based upon data collected in accordance with a specific research design. The association of a "cause" with the "effect" (i.e., cancer) must be strong, specific, and consistent, and there should be a believable biological basis for this association.

The design of epidemiological studies falls into a number of categories. In one category, a group (cohort) of healthy people are followed forward in time (prospectively) for a number of years to determine which of those individuals exposed to a particular substance are more likely to contract a particular

disease than those not exposed. These are the prospective cohort studies or follow-up studies. In a similar type of design, the follow-up is started not from the present, but from an earlier (historical) time. The cohort or the group being studied consists of persons who are grouped according to their amount of exposure to a suspected hazardous agent. Those groups are then compared to see if the individuals with higher exposure have higher illness or death rates. Studies of this kind would be referred to as historical follow-up studies. In both of these types of studies, the cohort would be comprised of some people who eventually will contract the disease and others who will not. If the number who contract the disease is small compared to those who remain healthy, and if the disease in question has a long latency period, the total number of persons in the cohort may have to be very large, and the follow-up time may have to be many years.

An alternative approach would be to locate a group of people who already have the particular disease, and compare their histories with another group (controls) who do not have that disease. Once the two comparison groups are located, the epidemiologist investigates their histories to discover if there are differences in the amount or circumstances of exposure to the suspected hazardous substance. This is called a retrospective case-control study.

Certain problems in studying cancer are peculiar to individual types of epidemiological design while others are common to them all. A very basic problem of all cancer epidemiological research is the difficulty of assembling a sufficiently large number of cases of a particular type for statistically meaningful conclusions to be drawn. In order to determine that a substance causes cancer, the epidemiologist must be able to accurately measure the different amounts of exposure (dose) among different groups of people, and then correlate the measurements with those people's health outcome (whether or not they get cancer). Some of the problems in doing the research are:

(a) Persons in the group being studied may have been exposed to carcinogenic agents at different levels with different frequency, and under different circumstances; these differences may not be known with any certainty.

(b) The same exposure may result in different outcomes for different individuals because of the presence of other factors (genetic predisposition, co-carcinogenic or synergistic effects).

(c) Follow-up is difficult with long latency periods during which time people may sicken or die from other causes or may move away so they can no longer be located.

(d) It may be difficult to get the cooperation of all involved parties (patient, organizations possessing records).

Students taking this course for credit should now read LeServe, Chapter 4, and Epstein, Chapters 2 and 3.

Animal Studies

Epidemiological or human studies cannot be relied upon as the only approach to the investigation of cancer causation. Given the many difficulties of epidemiological research which we have just discussed, it is clearly necessary to have some other methods of investigation which are more efficient and controllable. With modern science's tremendous ability to create new substances and the modern economy's capacity for putting these substances into general circulation, there must be other ways of testing rather than waiting for harmful effects to show up years later in human beings who have been exposed. Animal experimentation is an obvious resort. Epstein notes:

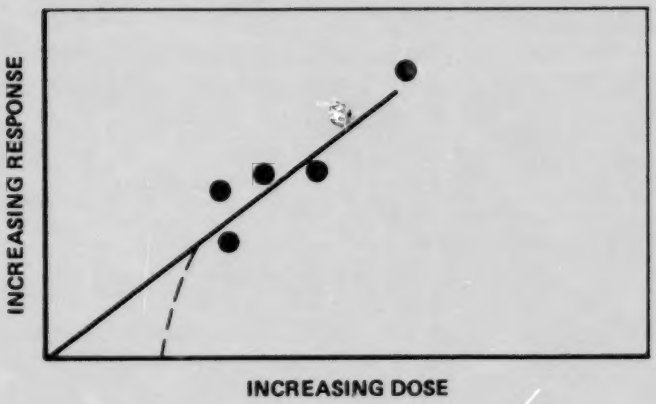
> "The legitimate inference that what is found to cause cancer in one species must also be assumed to cause cancer in others (known as the species-to-species extrapolation) is fundamental to cancer research. This inference rests on over half a century of intensive scientific investigation into the biology and chemistry of carcinogenesis and carcinogens in many organisms, including humans. Acceptance of the extrapolation principle is grounded in the fact that fundamental life processes in mammalian and other animals are basically the same as those in humans. Thus, information on the origin of cancer drawn from observations of animal experiments can be applied, with appropriate reservations, to man."
>
> (Epstein, p. 57)

Do we have any evidence that species-to-species extrapolation actually works? A table of chemicals known to be carcinogenic in humans (Appendix 1 in Epstein or Table 6 in LeServe) compares cancer induction in humans and in animals for 26 chemicals. We see that while there are considerable variations in different animals' responses and in the organs affected, in general chemicals which cause cancer in humans typically cause cancer in animals as well.

But, how are these animals tested? Have we not all read that scientists do strange things to laboratory animals like feeding them pounds of saccharin at every meal? Don't they sometimes inject large amounts of these chemicals into the animals in parts of their body that seem to have nothing to do with ordinary occupational or environmental exposures? Questions such as these are relevant not only to cancer studies, but also to any toxicological studies using animals. Particular considerations pertaining to animal experiments in cancer research include the (a) choice of animals; (b) ways in which carcinogens are administered to the animals; (c) dosages used; and (d) problems with finding the evidence and interpreting the results.

The dosage question is perhaps the area about which there is the greatest controversy and popular misconception. In particular, objections are focused on the extremes of large and small dosages. Large dosages are used in experiments as a matter of practical consideration. The illustration given by Epstein shows why animal testing must be done at dosages much larger than real-life levels of exposures. If rats and humans are equally sensitive to some carcinogenic chemical and this chemical causes one case of cancer in 10,000 people, then at an equivalent dosage, ten thousand rats would be needed to observe one cancer case among them. Cancer research is not going to advance under these circumstances. Even 10,000 rats are already prohibitively expensive, and a single cancerous one among them would not constitute satisfactory experimental evidence. Therefore, the dosage must be increased so that with a manageable number of rats, a statistically significant number of cancer cases could be observed.

Epstein identifies "two basic assumptions" in his further discussion of how animal dosages are varied in order to infer carcinogenic consequences for humans. These assumptions are that: (1) humans are assumed to have the same sensitivity as rats; and (2) equal proportions of tumors would occur at all dosages. The first assumption is used only as a justification for comparing people with rats and is not taken to be literally "true" since it is well known that humans and animals typically do not have the same sensitivities to the same substances. The second assumption, however, is required as a practical expedient. This assumption is technically called the linear dose-response extrapolation. Here, response refers to the number of cancer cases among a particular number of animals tested (let's say 50 rats). A dose-response graph would plot various dosages (milligrams of saccharin per day) against the correspondingly different responses (cancers per 50 rats), yielding something like the following:



A linear dose-response graph means that if 1 milligram per day produces 1 cancerous rat in 50, then 2 milligrams will produce 2 in 50, or 1/2 milligram (while retaining the same proportion of cancers) will produce 1 cancerous rat in 100. "Extrapolation" is necessary in the regions where it is no longer

possible to do an actual test, i.e., at the very low dose region where, with a modest number of test animals like 50, no more cases of cancer are seen. Does this mean that at this dosage and below there is no more carcinogenic effect? Or, do we suppose that if we took enough animals, we would always see the same proportion of cancer to dosage? If we can say yes to the former, we are asserting that the dotted line gives the correct description and that there is a threshold dosage. If we say yes to the latter, we would be claiming that the line can be extended straight down into the very low dose region, and that the response (or amount of cancer produced) is never zero unless the dosage is also zero. Both theories are hotly debated - those who extrapolate to small doses say there is no safe threshold level and state that no amount of exposure is considered safe; those who say that there is a safe threshold level state that small amounts of exposure (or dosage) are acceptable because there is not a significant risk of cancer at very low levels of exposure. Neither theory has been conclusively demonstrated to be correct. There are good arguments against the threshold idea such as those put forth by Epstein. On the other hand, the linear extrapolation is indeed only an assumption, since it cannot be verified in practice.

Another major problem with animal experiments obviously has to do with the number of animals used. If too few animals are used, it is difficult to get statistically significant results. A large number, on the other hand, becomes very expensive and difficult to handle. It would clearly be desirable to devise some alternative that could yield results with good statistical significance at modest cost and in a fairly short time. Accordingly, much research effort has been expended on developing test procedures that could rapidly screen various substances for probable carcinogenicity.

Rapid-Screening Carcinogen Tests

There are, at present, a number of screening procedures, the best known of which is the Ames test. The basis of the Ames and similar tests is the expectation that cancer-causing substances are likely to cause mutations (i.e. inherited changes) in cells. In the initial validation of the Ames test in 1975, about 90% of 174 known carcinogens were shown to induce mutations in bacteria and only 13% of 108 non-carcinogenic chemicals were found to cause

these mutations. While this is not a perfect score, it is certainly a very impressive correlation. One can argue on theoretical grounds that it is a long step from mutation in bacteria to cancer in humans, but one can hardly ignore the empirical success that has been demonstrated. Nevertheless, test results should be interpreted with caution. One cannot ignore the fact that in the 1975 test there were some 10% of the cases where carcinogens did not cause mutations and 13% where non-carcinogens did cause mutations.

In sum then, there is no absolutely certain test for carcinogenicity. Human, animal or rapid-screening tests all have problems associated with them. On the other hand, they can each contribute importantly to the identification of likely carcinogens, and their combined evidence can be very strong.

D. How is Scientific Information Used to Control Cancer Hazards?

The Occupational Safety and Health Administration (OSHA), a federal government agency, has proposed that cancer causation in one species of animals and a positive result in the Ames test taken together should constitute grounds for emergency action to reduce exposure in the workplace. How is exposure to these hazardous substances controlled? Another federal government agency, the Environmental Protection agency (EPA) has formulated "nine cancer principles" which summarize the scientific aspects of cancer and which serve as a basis for efforts to control carcinogens:

1. A carcinogen is any agent which increases tumor induction in humans or animals.
2. Well-established criteria exist for distinguishing between benign and malignant tumors; however, even the induction of benign tumors is sufficient to characterize a chemical as a carcinogen.
3. The majority of human cancers are caused by avoidable exposure to carcinogens.
4. While all chemicals can be viewed as potential carcinogens, only a small percentage actually are.

5. Carcinogenesis is characterized by its irreversibility and long latency period following the initial exposure to the carcinogenic agent.
6. There is great variation in individual susceptibility to carcinogens.
7. The concept of a "threshold" exposure level for a carcinogenic agent has no practical significance because there is no valid method for establishing such a level.
8. A carcinogenic agent may be identified through analysis of its ability to induce tumors in laboratory animals exposed to the agent, or on a post hoc basis by properly conducted epidemiological studies.
9. Any substance which produces tumors in animals must be considered a carcinogenic hazard to humans, if the results were achieved according to the established parameters of a valid carcinogenesis test.

Exposure standards

In the United States, the commonly used standards are the Threshold Limit Values (TLV) set by the American Conference of Governmental Industrial Hygienists (ACGIH). A TLV refers to the level of airborne concentration of a chemical at which it is believed that most workers may be exposed repeatedly with no adverse effects. Despite its name, the ACGIH is a non-governmental organization which includes academics, company doctors, and others.

The list of TLVs which began to be developed in 1946 has been revised, expanded, and includes a variety of toxic chemicals. Only a handful of the substances on this very extensive list are labelled as carcinogenic. The TLVs are the product of deliberations among ACGIH professionals based on available information: animal and laboratory experiments, epidemiological studies, observation of workers, etc. The difficulty of this task should not be underestimated. These values are purported to be set at levels below which there would be no harmful effects - hence, the idea of threshold. Is there indeed such a threshold value for every hazardous substance? (Many researchers would say "no.") The ACGIH itself also has doubts since its own specific

recommendation for carcinogenic substances is that no exposure should be permitted by any route. This suggests either that there is no threshold for chemical carcinogens, or if there is a threshold, we are not confident that we know where it is. Whichever may be the case, it is usually conceded that TLVs are at best estimates rather than scientifically proven quantities. Indeed, some of them are based only on educated guesses.

A generally more stringent set of levels are those of the Maximum Allowable Concentration (MAC) used by the Soviet Union. Here, the idea of "safe" requires that the amount of substance in question should not cause any biological or functional change in the body, not even changes which appear to be only temporary and reversible. Permissible levels are officially defined as follows:

> Maximum allowable concentrations (MACs) of harmful substances in the air of the working area are those concentrations that, in the case of daily exposure at work for eight hours throughout the entire working life, will not cause any diseases or deviations from a normal state of health, detectable by current methods of investigation, either during the work itself or in the long term.

While it may seem that the generally lower MAC values are more satisfactory from the worker's point of view, LeServe notes that "the stringent USSR concept has not resulted in a much healthier working environment." This raises the question of whether there is any truly safe level of exposure or whether the MAC values would give adequate protection but are simply not enforced.

In defining the Threshold Limit Values, the ACGIH specifies that they "represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect." The ACGIH further indicates that "Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the threshold limit; a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness." Simply stated they

are saying that different people do respond differently to toxic effects. Exposure limits, therefore, have uncertainties associated with both their definition and their practical application.

> Students taking this course for credit should now read LeServe, Chapter 2 in its entirety as well as Chapters 3 and 4.

Although scientific knowledge is supposed to be the basis for setting standards to control cancer hazards, much about the scientific nature of cancer and carcinogens is still unknown and controversial. The controversial issues will continue to be debated; in the meantime carcinogen exposure must be regulated and controlled. The next section of the manual covers methods of preventing cancer and of regulating carcinogens, including a discussion of the non-scientific factors (political and economic) that also play important roles in efforts to control cancer.

SECTION I ASSIGNMENTS

Direction: Locate three articles on cancer, one from each of the following kinds of publications:

1. a major newspaper (e.g. The New York Times).
2. a popular magazine (e.g. Time, Newsweek, Psychology Today).
3. a professional society publication (e.g. Journal of the American Medical Association).

These articles should be photocopied so that they may be studied carefully and may eventually be submitted together with the written assignments described below.

Write a report (3-4 typed pages) on each of these articles. In each report, answer as many of the following questions as are applicable:

1. In this article, can you find at least five topics or concepts which had been discussed in Section I? What are they and how do they come up in the article?

2. Does the text of the article give an adequate explanation of each of these topics or concepts? Or does it assume that you already understand them? (Note that you may have different answers for some concepts than for others.)

3. Do you find anything in this article that is misleading or inaccurate? Explain.

4. Does this article deal with any points of controversy? If so, what are these points and who are the people involved?

As you write these reports, refer back to your readings as needed. The object of this assignment is to have you apply the knowledge you may have gained in this section to an evaluation of cancer information presented in the mass media.

Section II

CANCER PREVENTION

A. What is Cancer Prevention?

B. Primary Prevention: Individual and Institutional Change

Introduction

1. Individual Resistance to Change
2. Organizational Resistance to Change
3. Prevention through Government Regulation
4. Primary Prevention in the Workplace
5. Economic Considerations in Cancer Prevention
6. Prevention through Education and Communication

A. WHAT IS CANCER PREVENTION?

Looking at environmental cancer in terms of prevention is a process which can shed light on the all-important question, "How do we prevent cancer?" It is important to understand that prevention refers to various kinds of intervention occurring in different stages of the disease process, and is not limited to a single time period or intervention method. The levels of prevention are known as primary, secondary, and tertiary.

The goal of primary prevention is to prevent the disease from developing at all, and is the only genuinely prevention-oriented of the 3 levels. Primary prevention efforts focus on the community while secondary and tertiary prevention efforts focus on the individual. Secondary prevention programs attempt to detect and treat illness in its earliest stages, while tertiary prevention programs attempt to limit the disabling effects of disease and prevent further physical, social or emotional complications. In both secondary and tertiary prevention efforts, the disease itself is not actually "prevented," but rather is diagnosed and treated to prevent its progression to a more advanced stage.

This chapter places heavy emphasis on primary prevention, the most effective, cost-beneficial, and sensible level because it attempts to prevent a disease or problem from developing. Primary prevention activities are geared toward maintaining health in a generally healthy population. This goal may be achieved through programs that eliminate the sources of disease, that reduce risks among the general population or among high-risk groups, or that support positive practices which promote well-being in people and increase resistance to harmful environmental or biological influences. In public health terms, the goal is to lower the number of new cases, or the incidence, of a disease or problem in a population at or during a specific time (usually in a year). For example, through health education we can promote better dietary habits and encourage people to stop smoking, thereby reducing the risk that they will contract cardiac and respiratory diseases and lung cancer. In another primary prevention program, smallpox vaccinations given to the entire population successfully controlled this disease; therefore, children no longer have to be vaccinated.

In the occupational cancer field, we can implement primary prevention programs at three levels. At the individual level, workers can improve their own health practices by using personal protective equipment such as respirators and gloves. These individual preventive health practices, while not attacking the cause of the problem, do reduce risks for the worker. Uniforms and showers can decrease the likelihood of carrying home agents such as asbestos dust, thereby reducing risks for families. The positive reinforcement provided by praise, recognition, special privileges and monetary rewards for improved individual worker health practices (Cohen, Smith, Anger, 1979) is an important vehicle for prevention.

At the organizational level, management can reduce or eliminate worker exposure to toxic substances by eliminating such substances from the manufacturing process, by plant engineering, and by implementing policies which safeguard workers' health. Measures such as adequate ventilation, careful air sampling, the maintenance of detailed medical records, and medical monitoring and surveillance programs (for example, tracking the amount of time individual workers are exposed to hazardous substances in a particular location of the workplace) all help to reduce risks.

At the community level, occupational carcinogens can be controlled or eliminated through public policy. Regulatory laws and administrative controls reduce risks for workers and for the general community.

The Clean Air Act (1977) is one example of a federal legislative effort to reduce community air pollution. Strict regulations regarding toxic waste disposal locations illustrate a local administrative effort to reduce community exposure to toxic industrial pollutants.

Secondary prevention occurs chronologically later in the disease cycle, after the disease process has been set in motion, either before initial symptoms appear (asymptomatic) or during their earliest stages. Early case finding and diagnosis, followed by immediate treatment, help reduce the duration and intensity of the disease or problem. A well-known secondary intervention program is the PAP smear, which detects atypical growth in cervical tissue.

A positive PAP smear indicates atypical changes that may or may not be cancerous. Appropriate treatment of newly identified cases can prevent the further development of atypical, and possibly cancerous, cells. Physical examinations conducted by industry, aimed at the early detection of illness, and followed by appropriate treatment, are examples of organizational interventions in secondary prevention.* The main goal here is to lower the prevalence or the number of both new and existing cases of disease in a population at or during a specific time (again, usually in a given year).

Tertiary prevention is often referred to as a level of "care" rather than "prevention." It occurs chronologically last in the disease cycle, and does not "prevent" the occurrence of an illness (as does primary prevention) or even the full development of symptoms (as does secondary prevention). After the disease process has resulted in well-developed symptoms, and has been diagnosed, tertiary treatment is aimed at limiting the disabling impact of the illness and preventing further complications in the individual's personal and occupational life. An important objective is to restore social functioning to the greatest extent possible so that the person can maintain a normal lifestyle. Counseling and rehabilitation programs, most forms of chemotherapy, radiation, and surgery are common tertiary interventions.

B. PRIMARY PREVENTION: INDIVIDUAL AND INSTITUTIONAL CHANGE

Introduction

If prevention is seen as the task of balancing a scale consisting of changing individual health behaviors on the one side and changing institutional or

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* In general these include an initial or preplacement examination, periodic and additional examinations as necessary, and one at the termination of employment. Records are kept by the physician hired by the employer and should be available to the employee. They must include the employee's personal medical histories; pertinent family medical history; work history; employee medical, work related complaints; specific test results, and the physician's diagnoses. Records of carcinogens, also available to the employee, are to be kept for 40 years. In the event of a change of ownership, all records must be turned over to the new owner.

societal behaviors on the other side, then the weight must be evenly distributed on both ends.

Individual change includes changing health practices and life styles; for example, making a decision to quit smoking (eliminating the cause) and forming habits that protect one's health at work, such as using personal protective equipment (reducing the risk).

Programs to promote institutional change have greater potential for preventing problems with large-scale social impact. They are often more difficult to implement than programs aimed at changing individual behavior since they require coordinated political action among frequently competing groups (labor, industry, government and community organizations), and occur relatively slowly. When such changes do occur, however, their impact can be tremendous and far-reaching, as illustrated by the implementation of immunization programs, Medicaid, Medicare, health insurance, and health standards in organizations. In the formative stages of such ventures, power quickly becomes an important issue. Labor, industry, and government have their own interests to protect and such interests often conflict. Even in the face of collective action by unions and public interest groups, the "social system" tends to resist change.

Commenting on primary prevention as a means of reducing exposure to carcinogens, Schweitzer (1982) states..."that any regulatory policy or decision concerning primary prevention action is likely to be effectively opposed by pressure groups with substantial resources and an ability to use the courts to improve their prospect for protection from interference." It is unlikely, for example, that tobacco will be eliminated from the marketplace in spite of the scientific evidence linking tobacco and cancer. While efforts to promote large-scale change should continue (for example, lobbying to eliminate widespread cigarette advertising), simultaneous efforts to promote individual behavior change are also important. If successful in influencing people to change their attitudes and to stop smoking, those efforts will help to eliminate smoking behavior as a cause of cancer. In addition, individuals who have become more health conscious may then become more conscious of other health hazards in their environments. Informed citizens can combine their individual efforts with others to ultimately have an impact on larger-scale policies;

e.g., they can organize a letter-writing campaign about environmental pollution to legislators.

1. Individual Resistance to Change

Although the ultimate cancer "cure" still eludes us, we do know much about the causes of cancer and carcinogen control. It is unfortunate that our health practices and social policies do not reflect the extent of our current scientific knowledge about cancer. No single factor is responsible for this lag. Our collective behavior is shaped by a combination of social, psychological, political, economic and cultural influences within the micro (individual, family) and the macro (organizational, community, societal) social systems.

At the individual level, one's personal feelings and beliefs, the specificity of one's knowledge about cancer, one's past experiences, current fears, and the tendency to ignore an unpleasant reality all affect an individual's ability to act. Actions on one's own behalf include such behaviors as changing one's lifestyle and habits (smoking, for example), adopting better health practices, and carefully selecting the most healthful consumer products. Taking positive actions for one's own self or for others is difficult if one feels helpless in the face of the status quo, pessimistic about working for change, and alienated from others in society.

For the worker, a reluctance to "rock the boat" and to speak up about unsafe conditions may stem from a fear of retaliation by management and the loss of a job. This situation typically occurs where workers do not have the support of co-workers and unions, where social isolation is greater, and where "learned helplessness" is reinforced in the organizational environment. According to Seligman (1975), "learned helplessness" prevails when conditioning leads one to expect that personal actions have no influence on a situation's outcome; the individual experiences a weakened sense of control and stronger emotional reactions. Since events seem unpredictable, one feels less motivated to respond to situations.

The end result of such psychological states is likely to be a feeling that change is out of reach and that one cannot control one's environment. To what

extent such feelings of helplessness are associated with the subsequent development of disease is still questionable. The community organization literature, however, has for decades supported the value of citizen participation in community and social issues both for healthier personalities and for better communities.

The basic feeling that one cannot alter individual or collective destiny contributes to a reluctance to make changes in lifestyles, personal habits, or choice of consumer goods. Some workers choose to stay with a hazardous job despite the availability of safer options, deciding that salary or convenience is worth the extra risk. Some workers who are educated about the synergistic effects of smoking and working with asbestos will continue to smoke, just as in the general population some people will choose to smoke in the face of overwhelming evidence of the link between smoking and cancer. These factors should not in any way decrease efforts to bring knowledge to workers and to the general public. Without knowledge, effective action is not possible.

Another major factor affecting personal change is the pressure to maintain income and social stability for oneself and for family members. An individual's inclination to act on his or her behalf or on another's behalf is affected by the degree of concern shown by co-workers about issues concerning health in the workplace, and by the interest of friends and neighbors in issues of environmental pollution which affect the health of the community. The more that workers are integrated into their neighborhood and community, the greater is the likelihood of participation in community life.

2. Organizational Resistance to Change

The following factors help explain the historic reluctance of organizations to implement changes in their operating systems:

1. Management is primarily profit-oriented; labor's primary interest is in its own welfare; these two interests do not necessarily coincide.
2. Systems in motion tend to perpetuate themselves; change is difficult.
3. Within an organization, value is generally placed on the status quo and on not making waves or upsetting routine.

4. In some instances labor and management may ignore hazards in order to protect jobs and maintain the status quo.

5. Collective action is hindered in the 75% of the workforce which is not unionized.

6. Many workplaces lack an effective strategy or vehicle for implementing necessary changes (e.g., unions or plant safety committees do not exist or are ineffectively utilized.)

Industry uses several strategies to maintain the status quo. One of these is a process by which an individual, in this case the worker, is seen as faulty and careless and as bringing on an illness or injury through his or her own negligence, bad health practices or habits.* Other strategies include using propaganda to convince the public of the safety of industrial products, attempts to minimize the risk of hazardous substances, and efforts to influence policy by political lobbying. Groups that are subject to industry's lobbying efforts and support their positions include the American Industrial Health Council and the Chemical Manufacturer's Association Lobby.

Students taking this course for credit should read Epstein, Chapter 10.

It is important to note that while systems do resist change, a pessimistic attitude in response to this resistance produces apathy. Concerted efforts are possible. The 100 million U.S. workers and the unions that represent 25% of them can join hands with professional organizations and with public interest groups such as the Sierra Club, Nader's Raiders, the Rachel Carson Foundation, etc. Together, these groups can work to promote change in the interest of workers and of the public. Such efforts to advance a point of view or position in the face of opposition are part of the competitive model for resolving conflict at the organizational level. This model dominates the labor-industry scene today.

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* The interested student can read Ryan, Blaming the Victim, 1976, for a fuller understanding of how this ideology develops and operates in relation to social issues and problems.

Collective action, however, does not necessarily imply a competitive or adversarial approach. There are several examples of a cooperative partnership model where labor and industry work toward shared objectives (i.e., a healthier work environment). The Oil, Chemical and Atomic Workers International Union and the Kaiser Aluminum Company have succeeded in cooperative labor-management efforts to reduce risks in the workplace. The Kaiser Aluminum Company has developed a videotape to inform its employees and its new workers about the hazards of substances common to the industry. Kaiser's active role in worker health and safety has also reduced worker exposure by improving ventilation control and by promoting plant medical exams, smoking cessation programs, and the use of safety equipment. However, cooperative ventures are still the exception to the rule. Such programs could be duplicated across the country. But when collaboration meets insurmountable resistance or when industry continues to focus only on an individual's work practices rather than on making more substantive changes to eliminate the hazard, unions and public interest groups are essential forces for change.

To bring about effective preventive intervention, then, both individual and institutional changes need to occur. Preventing exposure to cancer hazards poses special problems. Because of its long latency period, cancer is not as visible a workplace problem as are other health-related hazards, such as physical injury. This factor, along with the common misconception of cancer as a hopeless condition, results in more psychological and social denial than do other workplace health hazards. There are accounts of successful attempts by industry to modify worker behavior and practices in the use of protective equipment. These include an active role by management in finding appropriate reinforcers for worker behavior. Cohen, et al. discuss one industry's program to encourage workers to use personal protective equipment (Cohen, A, 1979). The employer must be willing to take the time and effort to establish a solid program based on principles of positive reinforcement (i.e., rewarding desired behaviors). We know that positive reinforcement to learn new behaviors is more effective than attempting to get people to unlearn unsafe acts.

Reinforcers such as money, praise from supervisors, and privileges, to mention but a few, depend on the specific situation. Finding the appropriate reinforcer is part of developing a good program, for what motivates one person or

group may not motivate another in the same way. Once new habits are learned, the chances are good that they will continue. But the larger battle over carcinogens in the workplace and over manmade pollutants in the waterways, soil, and air must be resolved at the institutional level, just as discrimination practices were greatly modified by the legislation of the 1960's. The Civil Rights Act could not wait for change to occur in individual attitudes and behaviors. In fact, individual behaviors and attitudes were shaped in many respects by the legislation. Just as unions are working by themselves, with other groups, and with industry to improve workplace conditions and to strengthen public policy, so individuals must become better informed in order to protect themselves and, through their knowledge, to enhance efforts toward change.

3. Prevention Through Government Regulation

The primary federal agencies involved in the regulation of carcinogens and toxic substances are OSHA (Occupational Safety and Health Administration), EPA (Environmental Protection Agency), FDA (Food and Drug Administration), and CPSC (Consumer Product Safety Commission).

> Students should refer to Sections III A and B of the study manual for the comprehensive listing of federal statutes and agencies involved with the regulation of toxic substances. Students taking this course for credit should now read Epstein, Chapter 9.

The 1958 "Delaney Amendment" of the 1938 Food, Drug and Cosmetic Act was one of the first pieces of legislation requiring a federal agency to automatically ban a cancer-causing chemical. The Delaney Amendment prohibits any cancer-causing agent from being added to food, and permits animal test results as acceptable proof of carcinogenicity.

Of special interest to workers is Public Law 91-596, the Occupational Safety and Health Act, passed in 1970 by Congress with vigorous support from labor groups and unions. The purpose of this law was to assure workers "so far as possible" healthy and safe workplaces. The law also created the Occupational Safety and Health Administration (OSHA) in the Department of Labor to develop,

regulate, and enforce standards, and to work with both employers and employees toward better health and safety conditions in the workplace.

Enforcing these regulations, however, is no small task. Each year over 6,000 new chemicals come into existence. An example of OSHA's inability to set strict occupational standards for even some of these chemicals is the now famous "Benzene Decision" of the Supreme Court. The early standard of 10 ppm (part per million) exposure to the chemical benzene provided some protection for exposed workers. In attempting to decrease the risk of leukemia from exposure to benzene even further, OSHA proposed lowering the existing benzene standard of 10 ppm to 1 ppm. This proposal was in response to an epidemiologic study which showed that even benzene levels below 10 ppm were not safe. Workers exposed to benzene levels between 10 ppm and 1 ppm had a higher rate of leukemia than those not exposed. The American Petroleum Institute challenged the standard and brought OSHA to court. In a 5 to 4 decision, the majority of the Supreme Court believed that OSHA had not proven that lowering the standard from 10 to 1 ppm would decrease the risk of developing cancer enough to justify the new standard. The long term implications of the Benzene Decision are still uncertain. For OSHA and other regulatory agencies, the decisions on where to set safe levels of carcinogen exposure have become more difficult. On the one hand, the agency is required to set standards to protect the health of working people. To do this, they must rely on scientific information. However, for benzene as well as for other carcinogenic chemicals, there is simply no adequate scientific documentation on the health effects of low level exposure. The scientific proof is not available, yet the Supreme Court is demanding scientific proof on which to base its decisions.

The Toxic Substance Control Act (TSCA) passed by Congress in 1976 was an attempt to address this problem, at least for future generations of chemicals. This legislation authorizes the EPA to obtain information from industry on the production, use, health effects, and other matters concerning chemical substances already in circulation or being newly introduced. In particular, TSCA now requires that all new chemicals be tested by new manufacturers prior to being placed on the market. All test results are to be sent to the Environmental Protection Agency for review, after which the EPA decides

whether further testing is necessary and whether the chemical should be considered a carcinogen or a toxic substance of another category. Unfortunately, TSCA has been beset by the same problems affecting other federal regulatory efforts. An inadequate number of staff and insufficient funds have hampered the EPA's ability to establish and carry out adequate testing and review procedures mandated by TSCA. As a result, chemicals are still produced without adequate testing. Nevertheless, TSCA is a step in the right direction in that it has shifted the burden of proof from the government and the public to the manufacturer of chemical products. The principle behind this shift is that a product should be proven safe before it is put into general use, instead of needing to be recalled after the governmental agency has conclusively demonstrated its harmfulness.

4. Primary Prevention in the Workplace

Although substituting safe for toxic substances or work processes is the preferred method of preventing exposure, there are some instances when the total removal of toxic substances from the workplace is not feasible. Industry can then offer important contributions in the form of engineering controls: technology can be instituted to protect the worker after a careful study of the problem and operations specifically designed to ameliorate the hazards. For example, safety and health regulations require certain levels of clean air. These can be met in various ways, one of the most effective controls being a well-designed ventilation system. Ventilation ducts must be able to remove toxic aerosols (dust, fog, smoke, and mist) and vapors (gaseous forms of solids or liquids) as well as controlling heat, cold and humidity.

Before installing a ventilation system, the industrial hygienist studies the severity of the problem by using air sampling devices to determine the amount of air contamination. He or she must consider factors such as time of day, work location and appropriate sampling instrument. A worksite may have much lower levels of contamination in the morning before activity stirs up workplace dust or may have very different levels of airborne contaminants depending on the type of work processes in specific areas of the plant. Instruments vary from personal sampling pumps to large instruments that measure the air. The correct one must be chosen, appropriate for the particular workplace.

Industrial ventilation is an important hazard control measure. Adequate systems are essential to a healthful workplace, especially where toxic substances are used. As with many other areas of prevention, contract language can include descriptions of an efficient system as a condition of work.*

> Students taking this course for credit should now read LeServe, Chapter Five, "Controlling Chemical Hazards."

Other engineering controls that prevent air contamination are the enclosure of work processes to control the amount of contaminants escaping into the environment, and safety disposal of toxic waste materials. A well-publicized example of the need for these measures is that of vinyl chloride (VC) contamination. VC, a carcinogenic chemical widely used in manufacturing plastics, is responsible for liver cancer deaths in exposed workers. When the Occupational Safety and Health Administration (OSHA) set VC occupational standards of 1 ppm, several industries enclosed their VC manufacturing and handling processes, giving workers a far greater measure of safety. Engineering controls should focus primarily on these preventive rather than cleanup measures for, as LeServe notes, "Prevention is better than cure with all disease; with occupational cancer, prevention is sometimes the only cure." Thus, special construction around storage tanks and careful inspection and replacement of deteriorating materials are obviously preferable to a leak of toxic matter.

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* Two references are useful for students interested in pursuing this topic. (See bibliography for complete reference.)

1. Stellman and Daum, Work is Dangerous to Your Health; Section on "Ventilation."

2. American Conference of Governmental Industrial Hygienists, Industrial Ventilation. This is a detailed diagrammed text that discusses specific ventilation designs. It is a standard reference, bringing together ventilation data from all parts of the country into one source.

Mechanization and automation can isolate hazards by restricting access and providing barriers, such as the total enclosure of metal spraying cabinets with the worker controlling the machinery from the outside. Electrostatic precipitation can suppress dust by giving particles a negative charge so they adhere to positively charged plates (in much the same way that iron particles adhere to magnets), and less harmful substances can be substituted for hazardous materials. These changes in processes are but a few of the control methods now used by progressive industries to prevent occupational health hazards.

In summary, some primary prevention efforts to reduce workplace-related cancer are more desirable than others. Eliminating or substituting unsafe substances or work processes with safe ones is the preferred method of controlling exposure. If that is not possible, engineering controls reduce exposure by isolating or enclosing the hazardous substance or by ventilating the workplace to reduce the concentration (or dose) of pollutants. Only when the above methods are not possible should administrative or personal protection controls be used. Administrative controls do not reduce the dose of the hazard in the workplace but do reduce the dose to the individual worker by providing for adequate work breaks and by rotating job tasks between those that involve exposure to hazards and those that do not. Personal measures to control exposure include the use of personal protective equipment (PPE) such as respirators, gloves, etc. and personal hygiene measures such as washing or not eating in contaminated work areas.

5. Economic Considerations in Cancer Prevention

Although there is much talk about the value placed upon health by the majority of the people in the U.S., it is unrealistic to discuss preventive measures without also considering their economic implications: what are the benefits and what are the costs? Evaluating costs and benefits is a controversial issue and must be considered from several points of view. From the employer's perspective, the cost of preventing workplace carcinogen exposure means additional overload - for screening, engineering controls, protective devices, and ongoing research into the safety of substances and processes used in manufacturing products. From the worker's viewpoint, the costs of not controlling

workplace exposure mean an increased risk of developing cancer and may appear much greater than the costs of controlling exposure. Historically, management has concerned itself with cost effectiveness - which type of control will give the greatest return for each dollar expended? In terms of the health of workers in our complex society, the calculations must include more than simple dollar costs. Theoretically, in a cost-benefit analysis, both costs and benefits are measured and compared so that decisions can be made according to which actions will be of most value to society. The net benefit to society is the total or gross cost of a disease less the cost of controlling or eradicating the disease.

Benefit = Cost of disease - Cost of control

Realistically, however, it is difficult or impossible to conduct a cost-benefit analysis or to accurately measure the costs of disease and the costs of control. How does one put a dollar value on life, health, or worker morale? Even if these costs could be accurately determined, decisions are often not made on the basis of a calculated equation. Since different segments of society bear different costs (and reap different benefits), actions are often implemented on the basis of which segment has the most power to influence the decision-making process. However, in spite of the limitations of cost-benefit analysis, this type of analysis does provide some basis for decision-making. Cost-benefit analysis is often applied to occupational health programs and regulations, but there are also other public health programs that can be analyzed in a similar way. Public screening, personal protection and environmental pollution control programs can all be analyzed to determine if a specific method of controlling or eliminating a particular disease will benefit society. Examples of public health screening include the innoculation programs of fairly recent years. Polio, a dreaded disease until the 1950's, has been eliminated - a clear case of the benefits exceeding the initial cost if considered in terms of the costs of lifelong medical care, loss of income, and the psychological impact a disabling disease has upon the entire family.

When conducting a cost-benefit analysis, one needs to consider both the direct and indirect costs of disease as illustrated in Figure 1.

Figure 1: Components of Economic Cost of Disease

I. DIRECT COSTS
- Personal Services
  - Hospital Care
  - Nursing Home Care
  - Physicians Service
  - Drugs
  - Nursing Service
  - Other Services
- Nonpersonal Services
  - Research Costs
  - Training Costs
  - Other Health Services Costs
  - Cost of Facilities Construction
  - Net Cost of Insurance

II. INDIRECT COSTS
- Dollar Losses Due to Mortality
  - Current Years
  - Previous Years
- Dollar Losses Due to Morbidity
  - Institutionalized Patients
  - Noninstitutionalized Patients

(Source: Crystal and Brewster, From Inquiry, Vol. 3, No. 4, p. 3-13 (1966). Used by permission of Blue Cross & Blue Shield Assoc. All rights reserved.)

In the case of a preventive program in a plant, direct costs include special equipment such as a ventilation system, protective clothing, personnel for record-keeping and inspection, and so on. Cost effectiveness may then be determined by selecting the best approach to reaching the chosen goal from several alternative approaches, the alternatives being detailed through a cost-benefit analysis.

It is important to avoid the common misconception that what is quantified is therefore objective and accurate. A major stumbling block in the process of calculating costs and benefits is the difficulty of quantifying certain effects. For example, it is difficult to see how a human life can be quantified, yet one way in which this has been done is the policy of insurance companies to award compensation based upon the age and potential earning capacity of a victim. Although some effects have not as yet been satisfactorily quantified, decision-makers often allow only those which have been quantified to dominate their consideration. Unquantified effects, while known to be relevant and important, are generally omitted from this procedure. This situation results in a bias which affects any selection process, and the decision-makers need to be aware of the nature of these biases (Lave, 1980).

Unfortunately, economic considerations are not always looked at as carefully or defined as precisely as would allow for the best choice of alternatives. Decisions are sometimes based upon incomplete information and imprecise cost estimates, and data may not take into account differences in the size of a company, or side benefits from a technological change. When considering preventive measures, many industries have been pleasantly surprised to find that preventive controls have resulted in increased production and costs far below the original estimate. A good illustration is that of industries using vinyl chloride (VC). When OSHA established a standard of 1 ppm for VC and insisted that this be achieved through engineering controls rather than by workers using respirators, estimated costs implied a severe economic depression for the industries. However, when the new technology was introduced it resulted in reduced labor costs. An addition advantage was discovered through the ability to save and recycyle VC - which previously had been lost into the environment. The benefit in reduced worker absenteeism and improved morale must also be included in any serious discussion of cost-benefit analysis.

It is in regard to abstractions such as how one values health, life, and job satisfaction that dollar cost analysis by itself is insufficient, yet the issue of implicit benefit is extremely important to the total prevention picture. Cost-benefit analyses are useful tools in making choices among effective programs; while they cannot be used in place of human decisions, they can inform management more fully and systematically of the alternatives.

Students interested in pursuing the topic of cost-benefit analysis should refer to the bibliography for recommended readings.

Personal protection has obvious benefits, yet we know that changing human behavior is difficult. While a worker may have expensive equipment supplied by the company, if he or she does not use it, the cost clearly exceeds the benefits. It might be illustrative to think about the cost of installing seat belts, the number of people who, by using them, have been saved from major injury, and the number of people who never use them. To change behavior requires persistence on the part of those who believe the change is beneficial. That persistence may take the form of education, public awareness programs, legal and engineering controls and even regulation - all adding to the cost, but possibly increasing the likelihood of improved safety for the individual.

6. Prevention Through Education and Communication

Effective efforts often require communicating to others what needs to be done in order to have a safer workplace. In some instances (for example, engineering controls or medical surveillance) communication may be at a technical level such that an audience of technicians will understand the language. When the information must be transmitted from one person to another who may be from a different background, the communication is at a personal level and needs to be considered from both the sender's and the receiver's point of view.

How a Message is Perceived: Student workers have suggested different methods of applying learning in a workplace or community setting: groups of workers can meet to informally exchange and share ideas; workers can plan for more organized presentations to union, management, community groups, and schools; education programs can help families become more aware of hazards to spouses and children. All or any of these are ways to communicate and must consider both the sender and the receiver of the message. What does this mean? For a moment let us look at an everyday communication problem. What happens when you, the reader, try to convey a message to someone else? If the message is simple enough, "Pick up a quart of milk" or "I'll meet you at 8 p.m.," perhaps there is no problem - although we have all experienced that sinking feeling as 7:30 p.m.

draws near and we are not sure where we are to be at 8 p.m. And was it skim milk? So even with the simplest message, you need to be sure you know what you want to convey. Perhaps you do, but does the other person understand you?

Several studies in the health field have illustrated common communication problems. One of these problems is the use of specialized terms which can sometimes result in misunderstanding. For example, in a study of the interpretation of common medical terms such as "heartburn," "jaundice," and "diarrhea," not only did different patients interpret the terms differently, even the doctors did not always agree with each other (though they did all agree on the meaning of "a good appetite") (Harlem, 1977). In an area such as occupational cancer there are many technical terms for chemicals, regulations, agencies, unions, and medicine; when using these terms, be sure that the audience understands their meaning. It is not difficult to adjust your message if necessary - spell out names instead of using initials or, in some cases, use initials instead of the name (for example, DNA instead of deoxyribonucleic acid).

A communication problem far more severe is that you and your listener may, as in the cases of the patients and doctors, have different meanings for the same words. Communication must always be seen as a process: the words are spoken, the hearer processes them for meaning and then accepts them. Communication does not occur if the processing function is not the same.

FIGURE 2

human word processor

words spoken words received

(Adapted from Harlem, "Triangle of Meaning," 1977 with permission from S. Karger AG, Basel)

As shown in Figure 2, you cannot go from A to C without processing for meaning. This means that if you take your classroom learning back to the workplace, you must consider the level of your audience in terms of understanding the subject and what language you should use in order to communicate effectively to co-workers.

The concept of "images" is being explored by many psychologists today. They believe that the way we perceive meaning depends greatly upon our prior experiences. Thus, purely descriptive data, while helping to assess an audience's background, may not be enough to allow us to understand their subjective reality. Subjective reality is formed by family, school, church, work, peers, and so on. Think for a moment of your own perception of this manual. How you have understood its contents depends upon your own images of what it says. If you are to take your perceptions and pass them on to others, you need to ask yourself what you have learned and how far you have developed your understanding of the material. Your reflections will help you decide how to phrase your talks, question, suggestions. Union representatives have a better knowledge of regulations but may know less about scientific medical areas. You may be in a position to interpret technical information: e.g., from a company physician to your peers. You should be better able to share that information because you have thought about how the message might be received. If you need to communicate with community groups, you need to consider that they may not be sensitive to the issues of your environment because they have never thought about them. These groups may work under quite different conditions and may think only of the costs which they fear will be passed on to the consumer if certain preventive measures are enacted at your place of work. Only when you communicate your concerns in their terms can you expect understanding and cooperation.

How knowledge can affect behavior: There are many theories about how and why people change their behavior. Positive reinforcement, or rewards, has been shown to result in new behavior adoption. It is often considered a more effective technique than attempts to teach people rationally why they should change their behavior. However, it is not always possible to give explicit rewards even though there may be an urgent need to effect a behavior change. Communication then becomes the essential way to promote the desired change.

The communicator should know that responses to messages may occur in various sequences and patterns. One commonly-encountered pattern is that the receiver gains knowledge (information) which leads to a change in attitude and then to a change in behavior. An example of this pattern would be for a worker to learn (as many of you have) that a substance he has been working with has been shown to cause skin cancer. Although he previously did not wear protective gloves due to an almost dare-devil attitude and because the gloves were a nuisance, after receiving the new information his attitude may change and he may begin wearing gloves voluntarily.

Another possible sequence of response to messages is that behavior change leads to attitude change which in turn leads to internalizing information. If behavior is changed first and is voluntary, then attitude and knowledge change will usually occur so that the respondent will not be in internal conflict with what is being done and what is believed. However, internal conflict may occur if the change was made because there was no choice given, since the person's attitude may remain the same and new knowledge may not have been provided or accepted. For example, if a regulation is arbitrarily imposed upon a worker, behavior may change, but beliefs and attitudes may well persist in a manner that is in conflict with the new behavior. Therefore he or she may disregard or block out information concerning the reasons for change. Another example might be an institutionalized patient whose beliefs forbid taking medication, but who is forced to do so by institutional authorities. The patient may take the medication, but there will probably be no change in attitude. This allows the patient to maintain his or her self-esteem because there was no choice given and so no internal conflict will result. Whether the change is voluntary or compulsory is often affected by the way the information is presented. This is important to understand when planning to communicate a message. To return to the example of the gloves mentioned above, if the worker was not informed about the hazards but only forced by a regulation to wear them, there would be every chance of a conflict between what was done and the worker's feelings about doing it.

Communication theory: mass media: Today, mass media is a commonly used tool for reaching the general public with important messages about health-related problems and programs. Radio, television and newspapers can bring educational programs, case studies, or current medical research into the homes of each

citizen. Although mass communications reach large numbers of people, this alone is not sufficient to induce changes in behavior. Personal interactions are also necessary. For example, the one-to-one communication that results from a feeling of trust between a physician and a patient is essential to the patient's willingness to accept a new form of treatment (Harlem, 1977). Personal health communication, however, generally does not reach the large numbers of people now being reached via mass communication. Combining both personal interaction and the mass media, though, may be the most effective technique, as was shown in a heart disease prevention program in California. A controlled study involved three communities: one receiving only mass media messages about smoking, exercise, and diet; a second receiving the same messages in addition to small group meetings between high risk males and experts who explained the effects of diet, exercise, and smoking on health; and the third group receiving no treatment at all (control group). All groups showed some changes: the mass media plus interpersonal exchange group (group two) showed the greatest changes while the control group showed the least. This experiment helps us to understand the importance of utilizing all available methods and of designing communications carefully in order to reach an audience most effectively.

Today's youth, for example, accepts mass media as a fixture in their lives. If life-saving health programs can be designed to meet their interest and motivate them to change their behavior by a fraction of the amount that TV's more popularly rated offerings do, then there may indeed be hope for cancer prevention via the mass media. While the ideal and the real may be far apart, the greater problem lies in not trying to bridge this gap at all. Positive aspects of technology should be used to prevent the negative ones, and mass media has that potential.

Knowledge is best learned when students can personally relate it to their immediate situation. As one student said, "I never knew it was like that. I feel as if a door has just been opened for me." Perhaps you can help someone find and open the door. In the preface to the LeServe text, Neil Kinnock states his hope that the book will be used to ensure "that knowledge is as much a key to safety as it is a means to power." It is this idea that should be emphasized as learning is shared with others.

SECTION II ASSIGNMENTS

Directions: Write out a complete answer to each of the following questions:

1. Self-assessment: Describe any direct or indirect experience you have had with cancer.

2. Why is tertiary prevention not really prevention? Why are primary and secondary truly prevention-oriented?

3. Discuss the three levels of prevention as they might apply to a problem such as the use of a liquid carcinogen in the workplace or the hazards of smoking.

4. Why is collective action essential to promoting change in organizations?

5. What is meant by voluntary compliance? How is it different from regulatory compliance?

6. Select four of the eight strategies used by industry and described in Epstein's Chapter 10. Give examples of how industry uses them.

7. Identify three ways in which the cost of prevention may be advantageous to management.

8. Why are dollar figures insufficient in computing the cost effectiveness of a program?

9. List the components of direct and indirect costs for a particular prevention program you may be familiar with (it could be an educational program, installation of a ventilation system, substitution of a carcinogenic substance by a safe substance, or any other).

10. What is a major problem in communicating health and safety information effectively?

11. Given a situation where you knew that you were working with dangerous substances, and that there were not adequate safeguards, how would you answer the following questions?

    How successful do you think you could be in getting other workers or the union involved in investigating health hazards at your work site?

    Do you think your job would be threatened if you were to report a hazard to a governmental agency? Explain.

12. If you were asked to give a presentation on an issue in environmental and occupational cancer to one of the following: 1) management, 2) a group of co-workers, 3) a community group, 4) a Parent Teachers Organization meeting, 5) a union membership meeting, you would need to know your audience. Select one audience and describe this audience in relation to their working and living environment. Show how this may affect their perception of your presentation, and explain how you will direct your presentation to this group's level.

SECTION III

TOPICS OF SPECIAL INTEREST

Introduction: Examples of Special Interest Studies

A. Radiation and Cancer: the Nature of the Problem

Sample Learning Contract

B. Literary Portrayals of the Workplace

Sample Learning Contract

C. Psychosocial Aspects of Cancer

Sample Learning Contract

D. Federal Intervention Efforts

Sample Learning Contract

Introduction

Students taking this course for independent study credit will need to pursue one topic in depth in order to satisfy the course requirements. Other students may wish to study on their own a topic of special interest which has been suggested either by this manual or by the student's personal experiences. Examples of special interest topics are:

- A look at the psychosocial aspects of cancer, including psychological factors, stress and the importance of communication skills.
- The relationship between cancer incidence and cultural or lifestyle differences.
- A consideration of hereditary traits as a predisposing factor to cancer.
- An examination of the relationship between radiation and cancer.
- A review of how the subject of cancer has been treated in literature.

This section of the manual illustrates several examples of how to conduct an in-depth study of a selected topic. Full references to suggested readings can be found in the bibliography. The sample learning contracts are given only as models on which studies of personal interest to students can be based. Final selection of a topic and development of a learning contract should be determined directly by the student and his/her instructor.

A. Radiation and Cancer: the Nature of the Problem

Radiation pervades our physical environment. As sunlight, radiation is a most necessary ingredient of life; in the form of cosmic rays, radiation may cause mutations which contribute to biological evolution on the one hand and induce cancer on the other. There are many different ways of categorizing the kinds of radiation: by physical properties, origins, effects, and so on. For purposes of protecting against damage, the distinction between ionizing and non-ionizing radiation is particularly important. While it would be simplistic to associate "ionizing" with "harmful" and "non-ionizing" with "beneficial" or "harmless," the hazards of ionizing radiation are especially worrisome because they are associated with such potentially serious health effects as genetic damage and cancer. For this reason, the term "radiation" is sometimes loosely used to mean ionizing radiation.

In terms of the physical phenomenon, ionization is the removal of electrons (negatively-charged particles) from a neutrally-charged microscopic atom when an energetic particle or ray passes nearby. If the original atom is part of a cell or a gene, ionizing it can have biochemical consequences. A large number of ionized cells can cause massive disruptions of bodily functions. Organ functions may be disturbed or may fail; cells may be depleted and their renewal hindered; the person may become acutely sick and may even die shortly after. As a rule, high exposure levels leading to such acute radiation sickness can only be found in situations such as industrial or laboratory accidents and nuclear war. In ordinary life situations the effects of ionization are much more likely to remain at the level of the individual cells and manifest bodily consequences only after a long time period. While high exposure levels are related to accidents and wars and low levels occur via natural and manmade radiations, intermediate levels are generally associated with occupational and medical radiation.

Following are several examples of lines of inquiry that students may wish to pursue:

a. A general survey of ionizing and non-ionizing radiations and their associated health hazards.

b. Environmental radiation: their origin, types, distribution, and significance.
c. Radiation sickness: acute and chronic.
d. Radiation carcinogenesis: mechanisms and research.
e. Radiation safety and control for industrial workers: radiation protection for consumers and citizens.
f. Biological effects of radiation.

When researching your topic, be aware of the limitations of our knowledge about certain aspects of the subject. Although much is known about the physics of radiation, (different types of radiation and how each type interacts with matter), less is known about the relationship of radiation to health. As Beebe (1982) states, "Although ionizing radiation has probably been the subject of more biomedical research than any other environmental agent, and its effects on human health may be better known than those of most, if not all, environmental agents, its significance for human health nevertheless remains highly controversial." The fields of radiologic health and regulation are evolving rapidly because radiation use is important in scientific research, in medical research, diagnosis and treatment and in the nuclear power and nuclear weapons industries. As with all fields of intensive research, definitions and descriptions change rapidly. Theories and explanations are constantly being modified because some may be proven wrong or become obsolete after being generally accepted for years.

Our varying levels of knowledge about different areas of radiation have important implications for selecting references for your own research. Because information about the fundamentals of radiation physics is highly certain and has been established for quite a long time, almost any introductory textbook on radiation physics may be used for this information, even if it is 20-30 years old. Besides textbooks, many other books and articles will also contain sections on the nature of radiation. Students can individually select from the suggested references based on the availability and readability of the desired references. The preface of most books usually indicates the audience for whom the book is intended. References on radiation and health effects must be chosen more carefully since older material may be out-of-date. Books will generally give a more thorough presentation of basic

information and a fuller discussion of the various aspects of the issue being researched, but periodical literature (current journals, newspapers, etc.) should also be consulted for updated information on the topic.

Sample Learning Contract: Radiation and Cancer

PURPOSE

To explore the controversies surrounding the effects of low level radiation.

LEARNING ACTIVITIES

1. Read Stellman and Daum, Chapter 6 for an introduction.
2. Examine the distinction between the effects of low level radiation exposure and those from higher level exposure. Read Upton.
3. Identify the major health concerns connected with low level radiation, and review the evidence for concern. Read selectively from the References.
4. Explain the extent of agreement and disagreement surrounding the evidence for concern about low level radiation exposure and the interpretation of that evidence. Read selectively from the appended References.

ASSIGNMENTS

At the conclusion of each of the above four study segments, write an essay (5-10 double-spaced pages each) summarizing and explaining your findings. Be sure to include a bibliography of the references used.

EVALUATION

The four essays will constitute the basis for assessing how well the student understands the subject matter. In the third and fourth essays where controversial aspects of the problem are especially important, care should be taken to identify the sources of data and opinions.

Books

International Labor Office. Manual of Industrial Radiation Protection, Part 3, General Guide on Protection Against Ionizing Radiations, Atar S.A., Geneva, Switzerland, 1963. This small manual contains a wealth of information in language accessible to the general reader and fulfills to a

remarkable degree its stated purpose of promoting "an understanding of the facts and philosophy on which .... regulations ..... are used."

Lipschutz, Ronnie D. Radioactive Waste: Politics, Technology, and Risk. Cambridge, MA: Ballinger, 1980. Written by a member of the Union of Concerned Scientists, this book discusses radioactive waste problems as particularly presenting human hazards.

Rosenberg, Howard. Atomic Soldiers: American Victims of Nuclear Experiments. Boston, MA: Beacon Press, 1980. The difficulties of establishing a cause-effect relationship between cancer and radiation exposure are seen through the health problems of veterans.

Stellman, J.M. and Daum, Susan M. Work is Dangerous to Your Health: A Handbook of Health Hazards in the Workplace and What You Can Do About Them. New York, NY: Pantheon, 1973. Chapter 6 (Light, X-Rays, and Other Radiation) gives a very clear and simple explanation of the hazards associated with the various forms of radiation.

Upton, Arthur C. Radiation Injury: Effects, Principles and Perspectives. Chicago: University of Chicago Press, 1960. Particularly targeted on the medical aspects of radiation injury, this small volume includes an extensive bibliography of research studies.

Government Publications

Interagency Review Group on Nuclear Waste Management, Report to the President, March, 1979. (Available from National Technical Information Service, U.S. Dept. of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.)

National Academy of Sciences. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation. Washington, DC: National Academy of Science Press, 1980.

Prendergast, Michael L. Ionizing Radiation and Worker Health: Abstracts of Selected Research. Cincinnati, OH: U.S. Department of Health and Human

Services, National Institute for Occupational Safety and Health, September, 1980.

Radiation Standards and Public Health: Proceedings of a Second Congressional Seminar on Low-Level Ionizing Radiation. Washington, DC: U.S. Government Printing Office, 1979.

Report of the President's Commission on the Accident at Three Mile Island. John G. Kemeny (Chairman), New York: Pergamon, 1979.

Three Mile Island: A Report to the Commissioners and the Public. Mitchell Rogovin (Chairman), NUREG CR-1250, Washington, DC: Nuclear Regulatory Commission, 1979.

UN Scientific Committee on the Effects of Atomic Radiation. Sources and Effect of Ionizing Radiation. New York: UN Publication E.77.IX.1., 1977.

Journals

This list includes both non-technical and fairly technical journals. Despite the more technical nature of some of the journals, they do contain some articles which can be read by non-specialists.

American Scientists
Bulletin of the Atomic Scientists
Environment
Environmental Research
Health Physics
Journal of the American Medical Association (JAMA)
Nature
Radiation Research
Science
Scientific American

Journal Articles

Archer, Victor E. "Occupational Exposure to Radiation as a Cancer Hazard." Cancer, 399 (1977), 1802-1806.

B. Literary Portrayals of the Workplace

Scientific writings in the professional media are not the only sources of information on the interaction between cancer and the environment, or on the effects of the worksite on employee mental and physical health. The vast literature of fiction, both American and foreign, can provide a fascinating insight into these problems from a different perspective.

Literature can be fictional, autobiographical, or biographical; often it is historical, sociological or psychological, and may lead the reader to experiences from the past, from other countries, and from all walks of life. From a novel portraying the conditions of migrant workers in the '30's to a poem that exalts the masses, to the human drama of a man losing his son to cancer, to many other dimensions of the human condition, research based on literature study will explore the many aspects of the effects of industrial growth upon individual people.

The best way to go about a literary study is, simply, to read. Some suggested works are referenced here, but you can explore other resources available in local or university libraries. As you read, it will be helpful to make notes on the type of cancer or health-related information presented in the work, on any emotional reactions the work brings out in you as a result of its treatment of the subject matter, and on any other aspect of the work that stands out in your mind. These notes can then serve as references for a term paper such as that suggested by the Sample Learning Contract. Be sure that the notes you take while reading contain enough information so that you can easily locate the reference later.

Sample Learning Contract: Literary Portrayals of the Workplace

PURPOSE

1. To understand the effect of industrial and technological growth upon the work environment.
2. To appreciate literature as a source of social information.

LEARNING ACTIVITIES

Choose from the selected bibliography or from other sources at least two novels (or one novel and some short stories), two plays, and appropriate historical background material such as a social history, biography, or autobiography.

As you read, keep in mind a topic for a final project and make relevant notes. Keep a journal that documents your personal reaction to each reading - what is there that inspires, angers, pleases? How does the author's style fit the times he or she writes about? In what way does each reading contribute to your knowledge about health hazards in the workplace?

The attached bibliography may be added to upon discussion and agreement with the instructor.

ASSIGNMENTS

Write two short (5-8 typed, double spaced pages) papers based on your notes. Meet every two weeks with the instructor for discussion and review of materials.

The final project may be a term paper, research, a creative endeavor, or some other expression of learning. It should show how the educational goals stated earlier have been met.

EVALUATION

Evaluation will be based upon the discussions with the instructor and the submission of written materials. Both discussions and writing will identify the major points the author is making and how they relate to an understanding of conditions at that time in the workplace and the larger community.

Papers will be evaluated for content and college level expository prose, including footnotes and bibliography.

Biography/Autobiography:

Hughes, Rupert. The Giant Wakes.

Social History:

Altick, R. Victorian Times.

Harrington, Michael. The Other America.

Terkel, Studs. American Dream: Lost and Found.

Terkel, Studs. Working.

Novels:

Eliot, George. Felix Holt.

Farrell, James. Studs Lonigan.

Tailor, Charles Kingley. Alton Locke.

Lawrence, D.H. Sons and Lovers.

Lewis, Sinclair. Babbit.

Llewellyn, Richard. How Green Was My Valley.

Sinclair, Upton. The Jungle.

Steinbeck, John. The Grapes of Wrath.

Plays:

Gorki, Maxim. The Lower Depths.

Hauptamann, Gerhart. The Weavers.

O'Neill, Eugene. The Hairy Apes.

Anthologies:

O'Rourke, William, Ed. On the Job. Vintage Books, 1972.

Spring, Michael, Ed. The American Way of Working. Bantam Books, 1980.

Poems:

Poets who write about workers and the workplace include Sandberg, Auden, Sterling, Brown and Roethke.

C. Psychosocial Aspects of Cancer

Because of the overwhelming physical nature of cancer, it is easy to focus our attention on the disease itself. Increasingly, research efforts are addressing the psychosocial factors of cancer, and are reminding us that there is a person behind the patient, a family and social group behind the person, and beyond them a larger community. For example, there is a health care system within the community in which the person resides; there are various environmental factors impinging on the health and lives of people; there are stresses and individual reactions to stress; there are personal life styles, behavior, and personalities, individual responses to illness, and a family constellation and dynamics; there are cancer trends within cultures; there are cancer costs to the patient and family, to the health care providers and to society; and there are indirect costs resulting from lack of productivity.

Psychosocial factors cut across prevention, diagnosis, and intervention strategies. Increasingly, we realize how important these factors are in gaining a comprehensive understanding of the complex of diseases known as "cancer." When choosing to study psychosocial factors, students can attempt to gain an overview, as the sample contract illustrates, or they can concentrate on selected factors (e.g., stress) as their research focus.

Sample Learning Contract: Psychosocial Aspects of Cancer

PURPOSE

To study the psychosocial aspects of cancer. Through this study the student will acquire an overview of significant social, psychological, economic, and political factors in the nature, causes, and prevention of cancer.

LEARNING ACTIVITIES

1. The student will read the following and will maintain a journal of personal reactions consisting of two or three well-developed paragraphs which summarize the thrust of each reading and note how each contributes to new learning. See the bibliography for the complete reference and for a brief description of each.

Cohen, Cullen, Martin, eds.	-	Psychosocial Aspects of Cancer Ch. 1-3,6,8,10,12,14-16,18,24.
Cohen, Fox, Isom, eds.	-	Cancer: The Behavioral Dimensions selections by Fox, Kegeles, Swineheart, Butler and Paisley, Enelow
Thomas, Duszynski, Shaffer	-	"Family Attitudes Reported in Youth as Potential Predictors of Cancer." Psychosom. Med. 41 (1979), 287-302.
LeShan	-	"Emotional Life History Patterns Associated with Neoplastic Disease." Annals, New York Academy of Sciences, 125 (1966).
Gunther, J.	-	Death be not Proud
Sontag, Susan	-	Illness as Metaphor
Epstein, S.	-	The Politics of Cancer
Simonton & Simonton	-	Getting Well Again

2. The student will meet every two weeks with the instructor to review the reading journal and to discuss ideas and questions.

ASSIGNMENT

A final paper (10-15 pp.) will be prepared on a relevant theme agreed upon by student and instructor. The student will integrate the learning from the readings and undertake additional research as necessary to develop the paper and to document ideas. This student manual may be used to generate other ideas and topics.

Alternatively, the student may design a field project which enhances the learning from this contract and prepare a final paper describing the project and the way in which it has expanded the student's knowledge of the psychosocial aspects of cancer.

EVALUATION

Evaluation will be based on the reading journal, the discussions with the instructor, and the final research paper, which should be appropriately documented; or on the design and description of the field project. The student should demonstrate an understanding of the major psychosocial issues, the role of research in contributing to our knowledge in this area, and the controversies surrounding the etiology, prevention, and to a lesser degree, the treatment, of cancer.

D. Federal Intervention Efforts

As a nation, we have become increasingly aware of the pervasiveness and dangers of the toxic and hazardous materials found in our environment - an environment which includes not only our homes and workplaces, but our air, water, food supply and virtually every other aspect of our lives. Exposure to these toxic materials may range from instances which are insignificant in their impact to those which are life-threatening in their severity. For this reason, numerous steps have been taken, particularly on the federal level, to learn more about the nature and effects of exposure to hazardous materials and to adequately regulate and control these substances in our environment. Paramount among federal activities to date are the nearly two dozen major laws governing the manufacture, distribution, use, discharge, and disposal of toxic and hazardous materials. There are a comparable number of federal agencies, departments, and bureaus responsible for carrying out the research, regulatory, and advisory programs mandated by these various statutes. In order to understand federal responsibilities and efforts relating to toxic and hazardous substances, you must become familiar with the various laws and the specific federal agencies responsible for implementing them. The acronym of the responsible agency is listed in parentheses at the end of each law in section A. Section B provides a description of these agencies.

A. STATUTES

Worker Protection:

Occupational Safety and Health Act (1970) -- protects workers against on-the-job injury associated with occupational exposure to toxic and hazardous materials (OSHA for regulation development and monitoring, NIOSH for research and training).

Federal Mine Safety and Health Act (1977) -- regulates toxic and harmful physical agents in coal or other mines (MSHA, NIOSH).

Commerce and Transportation:

Toxic Substances Control Act (1977) -- regulates the manufacture and distribution of new toxic chemicals (EPA).

Hazardous Materials Transportation Act (1976, amended) -- regulates the transporation of hazardous materials (MTB and USCG).

Federal Insecticide, Fungicide, and Rodenticide Act (1978) -- prohibits the sale, distribution or use of pesticides unless registered and used in accordance with label directions (EPA).

Atomic Energy Act (1954) -- regulates the processing, utilization, and distribution of radioactive materials (NRC, DOE, FDA, EPA).

Resource Conservation and Recovery Act (1976) -- regulates the generation, transportation, storage and disposal of hazardous solid wastes (EPA).

Waterways and Water Supplies:

Clean Water Act (1977, amended) -- protects, restores and maintains the chemical, physical, and biological integrity of the nation's waters (EPA).

Safe Drinking Water Act (1977, amended) -- protects public water systems used for drinking water and underground sources of drinking water (EPA).

Marine, Protection, Research, and Sanctuaries Act (1972) -- protects ocean waters from unregulated dumping operations (EPA).

Ports and Waterways Safety Act (1972) -- protects the nation's coastal areas and marine environment (USCG).

Other Environmental Media:

Clean Air Act (1977) -- regulates hazardous air pollutants discharged from new or existing stationary or mobile sources (EPA).

Comprehensive Emergency Response, Compensation and Liability Act (1980) -- more popularly known as "Superfund" -- a five-year trust fund to provide emergency and long term clean-up of oil and chemical spills and abandoned hazardous waste sites (EPA and USCG).

Consumer Oriented:

Food, Drug, and Cosmetic Act (1972, amended) -- prohibits poisonous or misbranded foods, drugs, or cosmetics (FDA and EPA).

Consumer Product Safety Act (1972) -- regulates the performance, composition, content, design, construction, packaging or labeling of consumer products (CPSC).

Poison Prevention Packaging Act (1970) -- requires the special packaging of certain household substances which may pose a hazard to children (CPSC).

Hazardous Substances Act (1960) -- prohibits interstate commerce of any misbranded or banned hazardous substance (CPSC).

Poultry Products Inspection Act (1957).

Federal Meat Inspection Act (1967).

Egg Products Inspection Act (1970) -- regulates the food, color additives and pesticide residues in meat and poultry products (USDA).

Fair Packaging and Labeling Act (1976) -- covers the packaging and labeling of food and drugs for humans and animals, as well as cosmetics and medical devices (FDA).

B. FEDERAL AGENCIES

(CPSC) Consumer Product Safety Commission
1111 18th Street, NW
Washington, D.C. 20460

Office of Public Affairs
(202) 492-5713
Hot Line - 800-638-8326

(EPA) Environmental Protection Agency
401 M Street, SW
Washington, D.C. 10460

Office of Public Affairs
(202) 382-4355
for general information on the Agency

Toxic Substances Control Act 800-424-9065
for information and free publications

"Superfund" Hot Line 800-424-9346
for information on the Comprehensive Environmental Response, Compensation and Liability Act.

(FDA) Food and Drug Administration
Department of Health and Human Services
5600 Fishers Lane
Rockville, MD 20857

(FSQS) Food and Safety and Quality Service
Department of Agriculture
14th and Independence Ave., SW
Washington, D.C. 20250

(USCG) United States Coast Guard
Department of Transportation
400 7th Street, SW
Washington, D.C. 20590

National Response Center
800-424-8802
to report spills of oil and/or hazardous chemicals

(MTB) Materials Transportation Bureau
Department of Transportation
400 7th Street, SW
Washington, D.C. 20590

(OSHA) Occupational Safety and Health Administration
Department of Labor
200 Constitution Ave., NW
Washington, D.C. 20210

(NIOSH) National Institute of Occupational Safety and Health
Parklawn Building
5600 Fishers Lane
Rockville, MD 20857

(NRC) Nuclear Regulatory Commission
Washington, D.C. 20555
Office of Public Affairs (202) 492-7715

(DOE) Department of Energy
Washington, D.C. 20585

Sample Learning Contract: Federal Intervention Efforts

PURPOSE

To examine the process by which Federal Agencies regulate and control hazardous materials by researching a particular problem involving a toxic substance.

LEARNING ACTIVITIES

1. Identify a problem for study: The problem could range from recent incidents in the student's community (e.g., discovery of toxic chemicals in the water supply), to situations involving national policy (e.g., off-shore drilling for oil).
2. Select readings from the Bibliography to acquire general background information about the selected problem.
3. Examine the pertinent federal statutes.
4. Read relevant periodical literature.

ASSIGNMENT

Develop a paper to critically analyze the federal role in regulating or controlling the problem. Include an analysis of the success and of the limitations of federal regulatory efforts.

EVALUATION

The student will meet with the instructor every two weeks. Evaluation will be based upon the student's:

1. Understanding of basic concepts and general background.
2. Knowledge of pertinent statutes.
3. Ability to distinguish between regulatory powers in principle and regulatory actions in practice as applied to the particular problem.

Publications:

The Toxic Substances Dilemma: A Plan for Citizen Action, National Wildlife Federation, Washington D.C., 1980

This excellent guide for the layman provides a clear explanation of toxics, their effects and risks, the federal laws controlling toxic substances, and advice for becoming involved.

Federal Activities in Toxic Substances, U.S. Environmental Protection Agency, Office of Pesticides and Toxic Substances, Washington, D.C., EPA-560/13-80-015, May 1980.

This document, though somewhat dated, provides an overview of major federal non-defense activities in toxic substances. It includes background information on the statutes and agencies covered in this article.

Toxic Chemicals and Public Protection, Toxic Substances Strategy Committee, Council on Environmental Quality, U.S. Government Printing Office, Washington, D.C., May 1980.

Cleaning Our Environment: A Chemical Perspective, 2nd ed., American Chemical Society, Washington, D.C., October 1978.

Occupational Health Guidelines for Chemical Hazards, Department of Health and Human Services, National Institute of Occupational Safety and Health, DHHS (NIOSH) Publication No. 77-181, U.S. Government Printing Office, Washington, D.C., June 1977.

Occupational diseases are discussed in terms of their health hazards as a guide to recognition of the disease.

Occupational Health Guidelines for Chemical Hazards, Department of Health and Human Services, National Institute of Occupational Safety and Health, and Department of Labor, Occupational Safety and Health Administration, DHHS (NIOSH) Publication No. 81-123, Washington, D.C., January 1981.

This comprehensive document summarizes information on exposure limits, chemical and physical properties and health hazards of hazardous chemicals in the workplace. It also provides recommendations for medical surveillance, personal protection and sanitation practices.

A Handbook of Key Federal Regulations and Criteria for Multimedia Environmental Control, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C., EPA-600/7-79-175, August 1979.

Journals and Periodicals:

Chemical and Engineering News, American Chemical Society, 1155 16th Street, NW, Washington, D.C. 20036.

Environmental Action, Environmental Action Foundation, 724 Dupont Circle Bldg., Washington, D.C. 20036.

Environmental Science and Technology, American Chemical Society, 1155 16th Street NW, Washington, D.C. 20036.

Hazardous Materials Intelligence Report, World Information Systems, 22 Hilliard Street, Cambridge, MA 02138.

Hazardous Waste News, Aspen Systems Corp., 1600 Research Blvd., Rockville, MD. 20850.

Occupational Hazards, Penton/IPC, Inc., 614 West Superior Ave., Cleveland, OH 44113

Occupational Health and Safety, Medical Pub. Inc., 5002 Lakeland Circle, Waco, Texas 76710.

Pesticide and Toxic Chemical News, 1101 Penn Ave. S.E., Washington, D.C. 20003.

Science, American Association for the Advancement of Science, 1515 Massachusetts Ave. NW, Washington, D.C. 20005.

APPENDIX A: GLOSSARY

Administrative Controls (pg. 47) - a method of preventing hazard exposure by changing work schedules; e.g. providing for adequate work breaks and rotating people between more and less hazardous job tasks. Administrative controls do not reduce the environmental exposure level but do reduce the dose to the individual worker.

Carcinogen/Carcinogenic/Carcinogenesis (pg. 22) - a cancer-causing agent or substance/Cancer-causing/Cancer-causation.

Cohort (pg. 23) - a group of people selected for epidemiologic studies who have a common background, e.g., born in the same year or working at the same workplace.

Cost-Benefit Analysis (pg. 47) - a form of decision-making whereby the expense of using a specific item or process is compared with the value expected to result from its use.

Cost-effectiveness (pg. 47) - the characteristic of an item or work process which is determined by comparing the value one gets from using it with the cost of its use. Decisions about choosing a method of workplace hazard control are often based on the cost-effectiveness of those different methods.

DNA (Deoxyribonucleic acid) (pg. 13) - proteins in the cell's nucleus that contain genes, the hereditary characteristics which are passed from one cell to the next and from one organism to the next.

Dissonance (cognitive) - personal conflict between contradictory attitudes or beliefs and behavior.

Dose (pg. 19) - the amount of a substance to which an individual is exposed; determined by the concentration of the substance and the length of exposure time, i.e. DOSE = CONCENTRATION X EXPOSURE TIME

Engineering Controls (pg. 45) - methods of primary intervention whereby workplaces are designed to reduce safety hazards or the level of hazardous substances in the workplace (e.g. ventilation systems, safety shields, etc). Of the three types of workplace hazard control methods (engineering, administrative and personal protective equipment), it is the preferred method because it reduces exposure levels to everyone in the workplace and leaves less chance for human error.

Epidemiology (pg. 23) - the study of the occurrence and distribution of disease in a population in an effort to determine the possible causes of that disease.

Exposure Standard (pg. 30) - the environmental level or concentration of a substance which is established by regulatory agencies and which cannot be exceeded. Exposure levels below the standard are determined either to be "safe" or to present a minimal health risk.

Extrapolation - the process whereby results of a test are applied to a situation which is assumed to be similar but cannot be tested. For example, animal tests results are applied to humans and test results of health effects at high levels of exposure are assumed to be similar to those expected at levels too low to measure (see also linear dose-response extrapolation).

Hazard (pg. 19) - source of danger.

Hypothesis (pg. 23) - an interpretation of events based on observation. Once an event is observed, a hypothesis is formulated to explain that event. The hypothesis is then tested for its validity and reliability.

Incidence (pg. 35) - the number of new cases of injury or illness in a population at or during a specific time period.

Initiation (pg. 22) - the first stage in a two stage process of chemical carcinogenesis in which a substance (the initiator) transforms a normal cell into a potential cancer cell.

Ion/Ionization (pg. 59) - an atom or group of atoms carrying a positive or negative electric charge; the process whereby an atom (or group of atoms) becomes an ion because it has lost or gained one or more electrons (negatively-charged particles).

Ionizing Radiation (pg. 59) - e.g., X-rays, gamma rays; radiation which carries enough energy to remove electrons from atoms thereby creating ions. Cancer is one of the serious health problems that can result if ionizing radiation strikes the body's cells.

Learned helplessness (pg. 39) - a passive state which occurs when an individual has been conditioned to believe that actions he or she takes will not affect the outcome of a situation.

Linear Dose-Response Extrapolation (pg. 7) - the assumption that equal proportions of cancer (response) would occur at any level of carcinogen exposure (dose), even at dosages which are too low to accurately measure (linear extrapolation from doses that can be measured to doses that cannot).

Maximum Allowable Concentration (MAC) - (pg. 31) - Soviet Union exposure standards which refer to the concentration of a substance to which workers may be exposed with no resulting biological or functional change in the body, not even changes which appear to be only temporary and reversible.

Metastasize (pg. 14) - the spread of cancer cells from the original or primary site to other areas of the body.

Mortality rate (pg. 16) - the number of deaths in a particular population of a certain size during a specified time period. Mortality rates are often given for groups of people in the same age or ethnic group, of the same sex or for the population as a whole.

Non-ionizing radiation (pg. 59) - e.g. ultraviolet radiation, microwaves, radiowaves; radiation that carries less energy than ionizing radiation so cannot damage cells by causing ionization but can harm body tissues by causing excessive heating.

Personal Protectice Equipment (PPE) - personal measures to control exposure to workplace hazards; e.g. respirators, gloves, etc.

Positive Reinforcement (pg. 42) - rewarding desired behaviors through positive feedback.

Predisposition (pg. 15) - susceptibility to a particular substance or condition.

Prevalence (pg. 37) - the total number of cases of injury or illness in a population at a given moment.

Prevention Programs (pg. 35) - in public health, this term refers to various programs aimed at preventing disease or the worsening of disease. Prevention programs are categorized by primary, secondary and tertiary prevention. (See those definitions.)

Primary Prevention (pg. 35) - efforts to prevent disease from developing by promoting people's health status to make them less susceptible to disease or by controlling or eliminating safety hazards or disease-producing substances in the environment.

Promotion (pg. 22) - the second stage of chemical carcinogenesis in which a substance (the promoter) stimulates the division and replication of a cell which has become abnormal in the initiation stage.

Prospective (cohort) study (pg. 24) - a type of epidemiologic study in which a group of people exposed to a particular substance are followed in time for a number of years to determine how many and which of those individuals develop a particular disease.

Retrospective (case-control) study (pg. 24) - a type of epidemiologic study in which a group of people who already have a particular disease (cases) are compared to another group who do not have the disease (controls). Both groups are examined to determine if they were exposed to different amounts of the substance suspected of causing the disease or under different circumstances.

Safe threshold level (pg. 28) - the controversial theory that there is a certain safe level of exposure to a hazardous substance below which there is no added risk of developing disease. Although this theory may be appropriate for some hazardous substances, it is generally accepted that there is no safe level of exposure to a carcinogen.

Secondary Prevention (pg. 35) - efforts to detect and treat disease in its earliest possible stage to prevent the disease from spreading or worsening.

Synergism (pg. 22) - an effect which, produced by two substances together is greater than the sum of the effects produced by each of these substances individually.

Tertiary Prevention (pg. 35) - treatment in the advanced stages of disease to prevent disability.

Threshold Limit Value (TLV) (pg. 30) - a US exposure standard which refers to the level of airborne concentration of a chemical at which it is believed that most workers may be exposed repeatedly with no adverse health effects.

Toxicity (pg. 19) - the ability of a substance to produce harmful effects.

APPENDIX B: BIBLIOGRAPHY

A. ANNOTATED REFERENCES

Anderson, Kim, and Ronald Scott. Fundamentals of Industrial Toxicology. Ann Arbor, MI: Ann Arbor Science Publishers, Inc., 1981.

This book was written to assist people in industry with little chemistry and biology background. It introduces the basic concepts and vocabulary of industrial toxicology. It is a complete and comprehensive text on the subject of industrial toxicology and contains an extensive list of references for more detailed study. This book is highly recommended as background reading for anyone concerned about industrial carcinogens.

Asbestos Killer Dust A Worker/Community Guide: How to Fight the Hazards of Asbestos and its Substitutes. London: The British Society for Social Responsibility in Science, 1979.

Asbestos Killer Dust is a thorough handbook with a clearly practical focus: helping people fight the hazards caused by asbestos exposure. The manual prepares readers to fight industry, government and, if necessary, their unions for their health. The advantages and dangers of asbestos substitutes are an integral part of this book. Each chapter includes a number of short, to-the-point "cases" which substantiate the issues raised. The text is frequently punctuated with documentary as well as comical illustrations. The political analysis of the asbestos industry in Britain and around the world is also important to the cohesiveness of the book.

The fact that this guide was written and published in the U.K. does not detract from its usefulness for a U.S. audience. The names are different but the story is basically the same. Where this does make a difference, such as addresses of manufacturers of asbestos substitutes, the information can be filled in with a little homework.

Ashford, Nicholas A. Crisis in the Workplace: Occupational Disease and Injury. Cambridge, MA: The MIT Press, 1976.

In this comprehensive report to the Ford Foundation, the author critically examines the entire range of issues - scientific, legal, political, economic and social, surrounding the multi-faceted problem of occupational health and safety. Since an in-depth analysis of each of the various perspectives is dealt with in separate chapters, the book serves both as a comprehensive study of specific areas of concern as well as an excellent overview of the entire range of issues, and may be read in part or in its entirety.

Bibliographic references and the OSHA Act of 1970 are included in the appendices.

Bacow, Lawrence S. Bargaining for Job Safety and Health. Cambridge, MA: MIT Press, 1980.

The major premise upon which this book is based is that public policy regarding health and safety in the workplace can be improved if private and public sector activities are complementary and not separate. The author analyzes how government might capitalize on the potential of labor and management to lessen job hazards through collaborative efforts and collective bargaining. The book is divided into three parts: Part I introduces the reader to the technical, economic, political and administrative problems to be overcome if hazards are to be effectively controlled; Part II evaluates the performance of OSHA in addressing these problems and offers suggestions for reform; and Part III explores the collective bargaining process through a series of case studies for the purpose of offering some ideas on how this approach can be applied to the enactment of public policy regarding occupational health and safety.

Berkley, George. Cancer: How to Prevent It and How You Can Help Your Doctor Fight It. Englewood Cliffs, NJ: Prentice Hall, 1978.

Several recent scientific studies are referenced and utilized in support of the thesis that nutrition, psychological factors, stress and other variables in lifestyle play a central role in the prevention of cancer. This book was written for the general public and requires essentially no scientific or medical background in evaluating the results and applicability of the findings reported.

Bowman, Malcom C. Carcinogens and Related Substances: Analytical Chemistry for Toxicological Research. New York: Marcel Dekker, Inc., 1979.

This text outlines and discusses some of the important principles and problems in the chemistry of toxicological testing and details much of the analytical methodology used in testing.

Although most useful to chemists and other scientists working in toxicological research, the book was also written to appeal to the layperson or to other scientists concerned with the investigation of carcinogens and related toxic substances.

Sections on the handling and disposal of chemicals and safety in the laboratory are also included. Extensive references can be found throughout.

Brodeur, Paul. The Asbestos Hazard. New York: The New York Academy of Sciences, 1980.

This 93-page book was derived for the most part from a conference held by the New York Academy of Sciences in 1978. It is a good introduction to the subject of asbestos. In eighteen 2-5 page chapters, topics progress from definitions, occupational exposures, and workplace controls to current and future environmental exposures and the question of social responsibility. Its length and format make this book easy and quick reading.

Brodeur, Paul. Expendable Americans. New York: Viking Press, 1973.

Expendable Americans is a detailed account of the author's investigation into workers in asbestos and chemical factories, following particularly the case of an asbestos plant in Tyler, Texas, which was shut down in 1972. It is a log documenting the mechanics of what Brodeur calls the "medical-industrial complex." Describing the activities of company doctors, "experts" and public health officials, Brodeur holds industry and the government responsible for neglecting disastrous working conditions and enforcement of the Occupational Safety and Health Act. This is a good book for anyone desiring a dose of reality about workplace health and safety as well as the frustrations involved in getting the facts and changing these conditions.

Cairns, John. Cancer, Science and Society. San Francisco: W.H. Freeman and Company, 1978.

This is a non-technical account of the cancer problem written for the general public and undergraduate biology students. It describes the scientific aspects of cancer: its origin and the varieties of cancer; the epidemiology of cancer; the history of cancer research; and the molecular genetics and fundamentals of research and treatment. It also examines cancer as a social problem, reflecting the problems of contemporary society; more specifically, the increase in life expectancy, exposure to hazardous byproducts of science and technology, and excessive personal indulgences.

The book is a well-written and fairly exhaustive review of cancer and its social aspects. However, the message with which many will take issue is that "almost all forms of cancer are caused largely or entirely by factors in our environment which vary from place to place and generation to generation."

Calabrese, F.J. Methodological Approaches to Deriving Environmental and Occupational Health Standards. New York: Wiley Interscience Publications, 1978.

This book deals solely with the biomedical basis upon which occupational health standards are, and can be, derived. It offers a good overview of how health standards are developed and explains the rationale and methodology underlying epidemiological studies and tests to determine exposure levels and effects. The author also discusses the need to develop reliable methods for testing and monitoring which can be applied to a wide variety of substances. This book is recommended for those seeking an understanding of the epidemiology and testing of industrial carcinogens, mutagens and teratogens.

Cancer Information in the Workplace: Annotated Bibliography of Educational Materials for Public and Health Professionals. NIH Publication No. 79-2001. Bethesda, MD: U.S. Department of Health Education and Welfare, 1979.

Prepared by the Cancer Information Clearinghouse for use in public worker and professional education programs, this bibliography identifies book, journal articles and audiovisual materials on a wide range of topics dealing with occupational carcinogenesis. Citations were selected and are arranged according to the audience for which they were judged to be appropriate. It is a valuable reference source for anyone interested in occupational carcinogens.

Choudhary, Gangadhar, editor. Chemical Hazards in the Workplace. Washington, D.C.: The American Chemical Society, 1981.

Based on a symposium sponsored by the American Chemical Society, this monograph describes the method of analyzing and sampling toxic chemicals and for monitoring air-borne particulates in the laboratory and work environments. A section reviewing new technologies and advances in screening and testing potential industrial toxins is also presented. This volume is technical in nature and is suitable reading for one with a good understanding of the chemical and biological sciences.

Cohen, Jerome, Joseph Cullen and L. Robert Martin. Psychosocial Aspects of Cancer. New York: Raven Press, 1982.

This book provides an inquiry into the emotional and social behavior of a public confronting the threat of cancer. By identifying and defining both the current issues in psychosocial research and the psychological and behavioral variables associated with cancer, the authors seek to answer the questions of why we fail to detect, prevent and cope with the problem of cancer. The implication is that the enlightenment of the public and utilization of the available knowledge by the public are key components in successful control.

Control and Prevention of Occupational Cancer, Report VII (1). Geneva, Switzerland: International Labour Office, 1972.

This booklet highlights the proceedings of the 58th International Labour Conference regarding the feasibility of mandating health and safety regulations of carcinogenic agents on an international scale. An introduction to occupational-induced cancer is given in Chapter I, while the laws and practices of various member countries and the problems of international regulation are briefly summarized in subsequent chapters. Two additional publications, Control and Prevention of Occupational Hazards Caused by Carcinogenic Agents (Report V, 1973) and Control and Prevention of Occupational Cancer (Report VII, 1973), contain the proposed text for international regulation, based on recommendations from responding countries, and the discussion and outcome of voting on the various provisions contained in the proposal.

Council on Environmental Quality, U.S. Department of Agriculture, Department of Energy, Environmental Protection Agency. Public Opinion on Environmental Issues: Results of a National Public Opinion Survey. 1980.

This report summarizes the results of a number of environment-related public opinion polls as well as reports on a survey performed by Resources for the Future of the Council for Environmental Quality. A number of topics are addressed, including spending for environmental protection,

protecting the environment vs. economic growth, the environment vs. energy, trends in concern about the environment, knowledge, and views on regulation. Reading this report, one cannot help but be impressed with the amount of support and concern the public has for environmental issues. Both the questions asked of survey participants and the tally of responses could provide material for interesting discussions in the classroom.

Counte, Michael A. and Luther P. Christman. International Behavior and Health Care. Boulder, CO: Westview Press, 1981.

The authors, both behavioral scientists with experience in educating health care professionals, examine the basic components of health and show how the definition of health and illness exert an influence on health-related actions and attitudes. This definition is shown to be determined by personal beliefs and values and by influences emerging from the social environment. Emphasizing how health beliefs and attitudes affect various types of actions, they describe how programs can be developed to help change health behavior.

This short book assumes only a very basic knowledge of the behavioral sciences.

Creasy, William A. Cancer: An Introduction. New York: Oxford University Press, 1981.

Intended as an introductory text for non-medical biology students, this book covers a wide range of topics dealing with cancer and cancer-control. Unlike many introductory texts which are aimed primarily at presenting the scientific and physiological basis for cancer and cancer-introduction in a more easily comprehensible manner, the aim here is to present and discuss the findings of diverse areas of cancer research in addition to those focused on the etiology of the disease. Hence, chapters and sections have been devoted to such topics as the incidence of cancer, the psychological factors influencing the disease and discussion of various methods of treatment.

The book is written in a language that is largely non-technical, making it suitable reading for anyone who wants to know more about cancer and cancer research.

Cross, John G. and Melvin J. Guyer. Social Traps. Ann Arbor: University of Michigan Press, 1980.

The central thesis of this book is that a wide variety of recognized social problems can be regarded from a point of view termed by the authors as a "social trap." Put briefly and simplistically, a social trap is a situation in which people are drawn into a certain behavioral pattern for which there are immediate rewards but longterm unwanted consequences. Two examples are cigarette smoking and environmental pollution. This approach is used to explain observed behavior in response to a number of social "evils" and is focused upon the relevance of psychological learning theories in understanding social behavior. Even though this book does not specifically address individual and social behavior as it is manifested in the case of prevention of occupational cancer, the theory and discussion are applicable to it as well as to a number of other social situations.

Cullen, J.W., B.H. Fox and R.N. Isom. Cancer: The Behavioral Dimension. New York: Raven Press, 1976.

The monograph of the 1975 conference on "Cancer Control and the Behavioral Sciences" sponsored by NCI's Division of Cancer Control and Rehabilitation, this book explores the application of behavioral science theory and skills to cancer and chronic disease, particularly as applied to health care behavior, communication, and coping with cancer. While occupational cancer is not a focus here, the wide range of articles by a number of medical and behavioral scientists is useful to both the student and the professional interested in achieving a broader understanding of the contribution of the behavioral sciences to cancer prevention and treatment.

Doll, Richard and Richard Peto. "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today." Journal of the National Cancer Institute. Vol. 66, No. 6, June 1981. p. 1192-1308.

Doll and Peto present a detailed review of existing data on current trends in cancer morbidity and mortality. This is one of the most comprehensive discussions of the various theories of cancer causation to date. The article is long and detailed, excellent for reference or for someone interested in a thorough understanding of the current debates about how much diet, lifestyle, occupation and the environment contribute to our cancer problem.

Egdahl, Richard H., Diana Chapman Walsh and W.B. Goldbeck, Editors. Industry's Voice in Health Policy. New York: Springer Verlag, 1979.

This is a special volume written by industry representatives about industry's role in health-care maintenance and delivery. The view taken is that while industry is not the answer to our health care woes, it can play a critical role in promoting the general welfare both at the community and national levels. Various health care options are examined and suggestions are made on how to initiate and encourage industry's involvement in public health.

Emmelot, P. and E. Kriek, editors. Environmental Carcinogenesis: Occurrence, Risk Evaluation and Mechanisms. New York: Elsevier/North - Holland Biomedical Press, 1979.

Although not specifically devoted to the area of occupational cancer, this monograph of the Third International Conference on Environmental Carcinogenesis (1979) contains valuable scientific discussion of the conflicting views over the incidence of occupational-induced carcinomas, the degree of risk associated with several known or suspected carcinogens, the level of risk over background that is acceptable, the efficacy of testing procedures, and the impact of continued use of toxic chemicals on the future.

Environmental Defense Fund and Robert H. Boyle. Malignant Neglect. New York: Vantage Books, 1980.

Malignant Neglect is an informative book written for a lay audience. The book begins with a definition of "the problem": cancer is an epidemic because we have not acted on the widely accepted understanding that most cancers are environmentally caused. It ends with "the solution," focusing primarily on changes individuals can make in their daily lives to reduce their cancer risk. The other aspect of the recommended solution is to get involved in the regulatory process. A comprehensive cancer policy is suggested. Sandwiched between these are nine chapters devoted to various aspects of environmental carcinogenesis including diet, drinking water, consumer products, radiation and the biology of cancer.

Epstein, Samuel S. and Joel B. Swartz. "Fallacies of Lifestyle Cancer Theories." Nature. Vol. 289, No. 5794, January 15, 1981. p. 127-130.

This article is a response to lifestyle theorists in general and in particular to Peto's review of Epstein's The Politics of Cancer. It begins by discussing the preponderance of chemical production and use in this century. Then the role of smoking, diet and occupation are analyzed. The authors conclude that the most important factors in preventing cancer are occupational exposures and smoking. Their position is that emphasizing lifestyle factors, especially when this places the blame on the individual or disregards the effects of multiple exposures on people who smoke, is misleading and unconstructive.

Epstein, Samuel S. The Politics of Cancer, revised edition. New York: Anchor Press, 1979.

Less controversial than the title suggests, this book serves as an excellent introduction to the area of occupational and environmental cancer both from a scientific and political perspective. Part I describes the epidemiological investigations of carcinogenic exposure and risk. Part II outlines several case studies on various occupational and

environmental carcinogens; and Part III examines both governmental and non-governmental policies along with a discussion of what the individual can do to prevent cancer. The main thrust of the book is that cancer is preventable but requires joint individual and political action.

Appendices, abbreviations and extensive bibliographic references are included.

Fishbein, L. Potential Industrial Carcinogens and Mutagens. New York: Elsevier Scientific Publishing Company, 1979.

The overriding purpose of this book is to bring together relevant facts about carcinogenic and/or mutagenic organic chemicals and compounds of industrial importance. The chemicals and related compounds reviewed are arranged by structural categories and the test systems used to determine their toxicity, the associated risk assessment data, the results of epidemiological studies and the mode of entry into and interaction with the body are described. This book is highly technical and is useful for studies requiring detailed scientific information.

Fraumeni, J.F., Jr. Persons at High Risk of Cancer. New York: Academic Press, 1975.

Based on the proceedings of a conference, this 6-part, 32-chapter volume is aimed at identifying high-risk cancer groups both in order to learn more about the causes of cancer and to direct limited resources in such a way that those at the greatest risk of contracting cancer will receive the maximum benefit of research and prevention programs.

Discussed in detail by scientists from various disciplines are known and suspected genetic and environmental factors contributing to the development of cancer, the problems and limitations in current screening programs and proposals for the orientation of future research and preventative measures.

Although some of the articles presented and much of the discussion following these articles are technical, certain sections, such as those dealing with environmental factors and public education, may be read with little difficulty by the non-scientist.

Gersuny, Carl. Work Hazards and Industrial Conflict. Hanover, NH: University Press of New England, 1981.

Although legislative reform since 1910 has substantially mitigated the conditions of the worker, industrial conflict continues as new hazards replace old. According to the author, this conflict, rooted in the underlying inequalities in risk of injury and occupational illness between the worker and those in power who decide what and how much risk is acceptable, is an unavoidable consequence of the dilemma between safety and productivity. Through a review and comparison of historical and contemporary case materials, it is shown that while legislation has changed the ground rules for conflict, channelling it into the political arena, class structure remains at the heart of current legal and political controversies over health standards. This book offers the reader valuable insight into the social, political, and economic factors confronting the worker and the community in the battle against occupational health standards.

Glucksberg, Harold and Jack W. Singer. Cancer Care: A Personal Guide. Baltimore, MD: Johns Hopkins University Press, 1980.

This book was written primarily to dispel myths and misconceptions about cancer cures and the opposite - certain death. It offers a brief and generalized discussion about cancer and carcinogens in the environment and provides information on the various types of cancer and their current treatment.

Greenwald, Howard P. Social Problems in Cancer Control. Cambridge, MA: Ballinger Publishing Co., 1980.

The author states that the problems attending the control of cancer are more properly defined as social problems rather than problems of economics, budget constraints or regulation. In outlining the problems of cancer control, he attempts to demonstrate the importance of interpersonal and organizational factors even in the presence of definitive legislative action and abundant material resources. Written for health care planners and analysts, this perspective has utility for the reader interested in the problems associated with the control of cancer, including those cancers linked to occupational hazards.

Grey, Jerry. Low Level Radiation. Atomic Industry Forum, 1974.

This short booklet introduces the reader to the subject of radiation, its uses and its effects on health. It also contains brief and simple explanations of models such as the linear and threshold theories, used to determine and set standards for levels of human exposure.

Handbook of Occupational Safety and Health. Chicago: National Safety Council, 1976.

Written as a guidebook for owners, managers and safety representatives, this book is intended as an introduction to occupational health and safety for persons with little health and safety experience. The major portion of the first half of the book contains advice and guidelines on how to set up an effective safety and health program and how to set priorities. Later sections contain information on worker attitudes and behavior, how to educate and communicate safety measures to employees and how to motivate employees to adopt safe health practices on the job.

The value of this book to the individual interested in the subject of occupational cancer is that it provides some insight into what is being communicated to employers, management personnel and workers about health regulations and practices.

Harlem, O.K. Communication in Medicine: A Challenge to the Professions. New York: S. Karger, 1977.

This book describes the process of communication and interpersonal communication in non-technical terms and then applies it to the specific area of transmission between doctor and patient and the general public. The author also examines the effective use in medicine of television and satellites as a means of educating the public. Intended primarily for medical students and personnel, this book should also appeal to those concerned with effective communication of medical facts but with little background in communication or the behavioral sciences.

Havelock, R.G. Planning for Innovation Through Dissemination and the Utilization of Knowledge. Ann Arbor, MI: University of Michigan Institute for Social Research, 1969.

Dissemination and utilization of knowledge are viewed as a transfer of messages by various media (linkages) between the resource, or sender of the message, and the user, or receiver of the message. In reviewing the processes of innovation, dissemination and utilization, this study concludes that senders and receivers can achieve successful linkage only if they exchange messages in a two-way interactive process and continually attempt to stimulate each other's problem-solving behavior. As such, effective communication depends upon the psychological disposition and attitudes of the resource and user, as well as sociological influences and needs. Successful linkage is not only effective, but builds a relationship of trust which aids in fast, efficient and effective information transfer. The implications of this study are that effective knowledge utilization requires a degree of labor division, coordination and collaboration throughout the social system and that the role of government should be to develop means to support and facilitate the knowledge flow system. The study concludes with recommendations for additional research and offers guidelines for practitioners and policymakers concerned with the use and flow of information to the public. This report provides a framework for understanding the dissemination and utilization of information and reviews the relevant literature in education and other fields. An extensive bibliography is included.

Hiatt, H.H. and J.D. Watson and J.A. Winsten (eds.). Origins of Human Cancer. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory, 1977.

This three volume set of books provides a comprehensive summary of the major issues in cancer research presented at the Cold Spring Harbor Conference on cellular proliferation in 1977. The papers cover a wide range of topics from cancer epidemiology to cellular changes to a thorough discussion of animal tests and short term bioassays. The material presented runs the gamut from highly scientific technical articles to easily understandable general policy. This is an excellent resource for both teachers and students.

Huseman, Richard C., Cal M. Logue and Dwight L. Freshley. Readings in Interpersonal and Organizational Communication, 2nd Edition. Boston, MA: Holbrook Press, Inc., 1973.

This collection of articles originally written for publication in various professional journals deals broadly with the subject of communication - its nature, inherent problems and the means to effective communication in the organizational and social frameworks. Two sections, one entitled "Communication and Conflict" which focuses on communication and conflict in various settings, and "Communication, Motivation and Persuasion" which deals with the important topic of how the individual can effectively influence society, are noteworthy.

Kessler, Irving I., editor. Cancer Control: Contemporary Views on Screening Diagnosis and Therapy. Baltimore, MD: University Park Press, 1980.

Cancer control here is broadly defined and includes "any preventative diagnostic or therapeutic modality that may decrease morbidity or mortality attributable to cancer." A volume containing contributions by several authors, it begins with a discourse on the breadth of the cancer problem worldwide and an overall assessment of the current status of the many approaches to cancer control and the prospects for the effective

control of cancer in the future. A review of the approaches to decision-making in cancer screening and suggestions for the selection of suitable cancer screening methods are also addressed.

Lusterman, Seymour. Industry's Roles in Health Care. New York: The Conference Board, Inc., 1974.

Based on a survey of over 800 large (greater than 500 employees) companies and interviews with executives, personnel directors and health professionals and planners, this report examines current health care programs provided by the employer, describing the advantages and disadvantages of the major health care options. In addition to statistical data on the type and quality of health care offered, the study also addresses such questions as the responsibility of the employer in providing occupational and non-occupational health care and the role of business in effectively ameliorating the problem of health care delivery in the United States. Opposing views on the various questions and issues are presented and future strategies for the improvement of health care policy are discussed.

Magee, Peter N., et. al., Editor. Fundamentals in Cancer Prevention. Baltimore: University Park Press, 1975.

The monograph of a symposium, this volume approaches cancer prevention from a wholly scientific perspective. It covers the range of scientific progress and problems in epidemiology, toxicology, screening, prevention and control. Suitable for those with a background in the physical sciences, with the exception of a chapter, "Thoughts on the Prevention of Cancer," the lay person may find much of the material presented a bit too abstruse.

Magid, King. Industrial Hazard and Safety Handbook. Boston: Neones - Butterworth, 1979.

This lengthy volume is unique in several aspects. Unlike other books of its type, it identifies and warns of the main hazards found in industry

and deals with common hazards rarely discussed, including those caused by or hidden in secrecy about industrial processes. Further, it demonstrates with great clarity how knowledge, training and understanding can prevent practices which lead to ill-health and can promote cooperation between management and workers. Written to appeal to a wide audience, this book serves as a good reference for either general or specific studies dealing with occupational health and contains extensive bibliographic materials.

Mendeloff, John. Regulating Safety: An Economic and Political Analysis of Occupational Safety and Health Policy. Cambridge, MA: MIT Press, 1979.

In the conflict over how much and what type of regulation of occupational health hazards is appropriate and necessary, critics of regulation (economists and business people) claim that the public must be educated as to how much it is costing the consumer to regulate social "evils." Supporters of regulation, on the other hand, argue that the benefits to society are underestimated. By considering the economic and political perspectives and social values, this study examines why we have the occupational health and safety policy we have, assesses how well it is working and proposes improvements. In the attempt to understand the way in which economic issues are considered in regulatory policy making, the author produces a highly polemic critique of OSHA and its social effectiveness.

A select bibliography and reference materials are provided.

Mettlin, Curtis and Gerald P. Murphy (eds.). Cancer Among Black Populations. New York: Alan R. Liss, Inc., 1981.

This is a collection of scholarly yet readable papers reporting on research in Africa, the Carribean and the U.S. The articles attempt to define the scope of cancer incidence and survival rates, speculate upon causes and propose preventive strategies. In doing so it is practically impossible to omit the social factors which present barriers to both understanding and affecting cancer among Blacks all over the world: the insensitivity of medical recording and census data, the quality of medical

services, the likelihood of having a dangerous job and poor overall health status, etc. These are presented in a straightforward manner which will be appreciated by anyone frustrated by the simplicity of most statistics regarding cancer rates among Blacks.

Moss, Ralph W. The Cancer Syndrome. New York: Grove Press, 1980.

The Cancer Syndrome is an attack on "the cancer establishment," Moss's term for the group of individuals, medical centers, organizations and government agencies at the center of most efforts involving cancer in this country. Due more to similar interests than to conscious design, the members of the cancer establishment work together to insure that research and treatment of cancer proceed in a direction which benefits themselves rather than dealing with the problem effectively. In a well-written and meticulously documented work, Moss investigates the "proven methods" of cancer therapy, "unproven methods" and prevention.

Proctor, Nick H. and James P. Hughes. Chemical Hazards of the Workplace. Philadelphia: Lippincott, 1978.

The philosphy underlying this work is that in order for OSHA to be at all responsive and effective, the quality of occupational health care requires attention. Thus, the book was written to provide occupational health physicians and specialists up-to-date reference and educational material. Assembled is basic information regarding the chemical, physical and toxicological characteristics of carcinogens and mutagens found in the workplace, criteria for diagnosing, testing and treating occupational diseases and guidelines for preventing, monitoring and controlling exposure. This monograph is comprehensive, not too technical in language and descriptions and need not be read in its entirety.

Public Opinion on Environmental Issues; Results of a National Public Opinion Survey. CEQ/USDA/DOD/EPA. 1980.

This report summarizes the results of a number of environment-related public opinion polls as well as reports on a survey conducted by Resources

for the Future, the Council for Environmental Quality. A number of topics are addressed, including spending for environmental protection, protecting the environment vs. economic growth, the environment vs. energy, trends in concern about the environment, knowledge, and views on regulation. A survey of the respondent's answers reveals that the public is concerned about the environment and overwhelming in support of environmental protection measures. This report provides a good starting point for various additional analyses.

Purdon, P. Walton and Karl L. Gabriel. Environmental Health, 1st Edition. New York: Academic Press, 1971.

A comprehensive overview of the "man-environment-health" interaction, this text is concerned with the interaction of man and his environment as it affects his mental and physical health and social well-being. Environmental conditions that foster the transmission of disease and exposure to chemicals and hazardous physical conditions are reviewed. Although not confined to the subject of occupational cancer, this text provides a broad range of perspectives for anyone with a general interest in environment-health interactions and serves as a substantial base for those who desire to further pursue specialized areas. The authors do, however, assume a familiarity with the basic sciences.

Three chapters are of particular interest to those concerned with occupational cancer. These are: the introduction, "Environment and Health," by Purdom; "The Occupational Environment," by Gabriel; and "Ionizing Radiation," by Jack C. Rogers.

Radiation Protection: A Systematic Approach to Safety; Vols. 1 and 2. New York: Pergamon Press, 1981.

A collection of papers presented at an international symposium, this book focuses on the wide range of issues associated with both occupational and patient exposure to radiation. In addition to containing the purely scientific and research oriented aspects of the monitoring and release of radioactive emmissions, risk measurement and quantification and the

biological effects of exposure, other topics include: the ethical and legal problems associated with exposure and risk assessment; emergency planning in the event of accidental or intentional release; and a description of non-ionizing radiation. Although many readers may find some of the material to be too technical to be of benefit and may wish to skip over these sections, the book offers a valuable overview in this area and is worthwhile reading for anyone interested in occupational cancer resulting from exposure to radiation.

Shaw, Charles R., Editor. Prevention of Occupational Cancer. Boca Raton, FL: CRC Press, 1981.

The several contributors to this volume explore the questions of "what is cancer" and "how much is caused by occupational exposure?" Intended to appeal to the level of the educated layman, their major purpose is to give the reader enough reference and detail to enable him or her to pursue further any one of a number of specific issues or problems. Individual chapters deal variously with such topics as the action, metabolism and epidemiology of known and suspected carcinogens, the identification of carcinogens through animal and short-term testing, the laws and regulations governing occupational carcinogenesis, prevention, workplace safety and the roles and responsibilities of society, the employer and the worker in the effort to abate occupational cancer. Not included in this overview is a section on ionizing radiation but most of the preventative principles discussed can be applied to it as well.

Showalter, David. How to Make the OSHA - 1970 Work for You. Ann Arbor, MI: Ann Arbor Science Publishers, Inc., 1972.

Another source book written for managers and employees, it approaches health and safety practices from the perspective that OSHA can work to effectively reduce occupation-induced illness and disability and that it can be profitable for the employer. The scope and intent of OSHA - 1970 are interpreted in simple, straightforward language and the salient points of the regulation are outlined.

Smith, Robert S. The Occupational Safety and Health Act: Its Goals and Its Achievements. Washington, D.C.: American Enterprise Institute for Public Policy Research, 1976.

The view put forth in this short book is that the basic problem with the implementation of the Occupational Health and Safety Act of 1970 is that there is no fundamental agreement either on the Act's goals or on the methods of balancing considerations of safety and health against considerations of cost. By examining the essential features of OSHA, its administration and its impact, the author argues that the health and safety mandate of OSHA is inconsistent with the promotion of general welfare and proposes the "more defensible alternative" of allowing the workers to decide how much safety they want. Technical and statistical data are offered as evidence in support of the claims and proposals made in this study.

Sontag, James M., Editor. Carcinogens in Industry and the Environment. New York: Marcel Dekker, Inc., 1981.

This is a thorough and comprehensive treatment of the scope and complexity of the problems arising from the use of cancer-causing agents in industry and in the environment. It introduces the reader to the scientific, legal, social and economic considerations in the testing, monitoring, and setting of standards and regulations for carcinogenic compounds. One major difference between this and other books of its type, which the reader may find both interesting and useful, is the discrimination made here between compounds labelled "serious hazards" and those considered to involve "marginal risk."

Sontag, Susan. Illness as Metaphor. New York: Farrar, Straus and Giroux, 1978.

An entirely different perspective on those factors which influence the prevention and treatment of cancer written by one who has had to deal with the reality of cancer, Illness As Metaphor raises objections to the fantasies and metaphorical thinking that surround the subject of cancer.

Using examples taken from literature, from current psychological reports on the nature and causes of cancer and from news articles, the author attempts to show both how widespread the cancer metaphor is and how dangerously it distorts the truth about cancer and cancer patients. The view taken is that the use of cancer as a metaphor is rooted in the insufficiencies and real problems of our culture and the hope expressed is that once cancer is demystified - once the causes are known and the recovery rate high - it will also be "demythicized."

Upton, Arthur. Radiation Injury: Effects, Principles and Perspectives. Chicago: University of Chicago Press, 1969.

This small volume is targeted on the biomedical aspects of exposure to radioactive particles. It includes an extensive bibliography on recent research studies in this area.

Whelan, Elizabeth. Preventing Cancer. New York: W.H. Norton and Co. Inc., 1978.

According to this author, the effective control of cancer is not a curative process but a preventative one and is dependent upon both environmental changes and individual action. This book is directed toward the latter, that is individual action, with the purpose of prescribing what the individual can do to avoid cancer. The discussion of occupationally related cancer is very brief and the reader may find the author's exoneration of certain environmental "hazards" somewhat objectionable.

Winick, Myron. Nutrition and Cancer. New York: John Wiley and Sons, 1977.

A more technical handling of the topic, this book examines the relationship between nutrition and cancer in three aspects: in the etiology of cancer; in cancer as it affects the nutritional status of the patient; and nutrition as a method of treating certain cancers. In each of these areas the research to date is described and suggestions are made for future research.

Winters, Ruth. Cancer-Causing Agents: A Preventative Guide. New York: Crown Publishers, 1979.

A worthwhile reference for the layperson, this book contains information on known and suspected carcinogens. Definitions of the chemical terms used and of the types of cancer induced are provided along with additional references for each chemical listed. A brief overview of epidemiologic studies, pertinent statistical information and the theories and mechanisms associated with cancer induction are given in the introductory chapters.

Wolf, Steward, John G. Bruhn and Helen Goodell. Occupational Health as Human Ecology. Springfield, IL: Charles C. Thomas Publications, 1978.

Stating that "...occupational health cannot be thought of merely as a medical specialty - it is everybody's business...," the author examines the role of the worker, industry, the unions and the medical professional in generating and maintaining a responsive and effective occupational health program. Central to the development of such a program is the recognition that current health hazards differ significantly from those of the past. To support these points, the author traces the evolution of occupational medicine, discusses current practices and legislation in terms of the major threats to health, including worker attitudes and behavior, and outlines an occupational health program based on an expanded view of occupational health.

The book is brief and easily readable with references provided after each chapter.

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